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## INVADING THE RURAL DISTRICTS.

The acquisition of off-peak loads is an attainment towards which every central station is, or should be, striving. The more progressive managers have realized that a promising field for their endeavors is to be found among the farmers and are invading the rural districts. The farmer has use in his household for all the applications of current which interest the city resident, and in these days of profitable farming he is ready to install them. It has become increasingly hard to get sufficient labor on the farm at the wages which the farmer can afford to pay, and in the East many farms have been abandoned from this cause. The time is very ripe for the introduction of labor-saving devices, in the house, the workshop and the field. The electrically operated washing and ironing machines and similar apparatus make it possible for the farmer's wife to get along without help in the house. The application of motor drive to many small tools and machines, such as saws, feed cutters, baling machines, corn shellers, etc., would make additional farm hands less necessary.

But the strongest point of appeal to the farmer is irrigation by the use of the motor-driven pump. The pioneers on the once-arid deserts of the West have demonstrated the possibilities of sure crops and no failures. These new farms are permanent object lessons to the old-style farmer who has been accustomed to an occasional off-year of drought and a renewal of the mortgage. Supplementary irrigation is appealing to the progressive farmers in those sections which are usually supplied by rainfall, but which are occasionally subject to drought, and what section is not?

The farmer's first contact with electricity has usually been by means of the telephone. This has invaded nearly every section of the country and has become a necessity. It has made the electric current a more familiar thing, a trusted servant. The farmer is ready to apply it further. If its introduction is justified by business reasons, it will be further applied to the nonessentials in dozens of different ways. Electric lights will be one application which will not constitute an off-peak load, but it will be a small part of the whole.

It is time for the power station to reach out and offer these potential customers what they need. Especially in fruit-growing and truck-farming sections are the possibilities many. These sections are frequently near large centers

of population where central stations are located and where comparatively short extensions of line will reach the farms. These extensions of line are the only capital expenditure required of the power company. If off-peak customers are secured, no enlargement of plant is necessary and attractive rates can be offered. An enormous field is awaiting invasion, and the enterprising solicitors are already busy.

## CHAINS AND BELTS.

Two interesting papers on methods of power transmission were recently presented in Great Britain, one on chain drive before the Incorporated Institution of Automobile Engineers, and the other on belt drive before the Lancashire section of the British Association of Managers of Textile Works.

In the former paper, Mr. A. S. Hill epitomized the advantages of chain drive substantially as follows: (1) The drive is positive. (2) The efficiency is high, being sometimes as high as ninety-six or ninety-seven per cent for the complete drive. (3) Tension is unnecessary to make the chains grip the wheels, as is the case with belts. (4) There is a minimum of journal friction. (5) With "inverted-tooth" chains there is an absence of noise in running. (6) In general, very little space is occupied and the difficulties of cramped and awkward positions are obviated. (7) Efficient service is given at center distances too short for belts and too long for gearing. (8) Satisfactory operation is afforded under hot or damp conditions of service in which belts are at a disadvantage. (9) Chains usually wear out rather than break directly under normal load.

In the paper on belts, Mr. Arthur Chadwick laid particular emphasis on the necessity for keeping belts in proper order. In this connection he told of a firm that inaugurated a systematic system of caring for its belts, with a result that in the year following this policy there resulted a saving of forty per cent compared with the cost of the previous year. Mr. Chadwick, in comparing solid-woven cotton belting and hair belts, asserted that the latter was the more suitable for heavy drives. In discussing the methods of finishing these woven belts, he stated that the commonest process is to steep the belt in various kinds of oil and then to cover it with a coat of red oxide. There was a tendency nowadays, however, to use a black finish, the advantage of which is that every fiber is soaked through with a preparation which feeds the belt from the inside instead of giving it only a coated surface. This prevents the belt from running too dry and the inside plies from cracking, and another advantage is that dressing put on the back seems to soak readily to the face. Furthermore, such a belt so treated will stand steam or acid fumes, which a leather belt will not.

Regarding the piecing of belts, Mr. Chadwick favors the drop joint for dynamo driving, or in any similar case where a butt joint would cause excessive jumping. The drop joint is also very suitable for piecing large belts. Piercing should preferably be done with an awl, as this insures a longer life of the belt than when the holes are punched out. Particular care should be taken to keep all bolt holes level.

The tensile strength, said Mr. Chadwick, is of great importance, but must be considered with thickness and elasticity. A ramie belt is exceptionally strong, but has very poor elasticity, and a jute belt is very similar. Hair or leather contains suppleness and ability to receive shocks, and the advantage of hair over leather is that this suppleness is more prominent and that it has a greater tensile strength when stretched to a breaking point. The stretch in leather comes out at low strains, and when it has all been gotten out and the work requires an increase in strain the belt will contain no reserve force, and will break without warning, or will slip over the pulley without doing the work. A sewn cotton or solid woven cotton belt has a better result in this respect than leather. A three-inch hair belt loaded at 200 pounds per inch of width, or a total load of 600 pounds, stretched one and one-half per cent approximately, whereas leather belting four inches wide, one-quarter of an inch thick, and ninety-two feet long, with a total load of 500 pounds, stretched by the increase in load from fifty pounds to 500 pounds by 1.83 per cent, in addition to what may have taken place at fifty pounds, which had not been registered. For low strains a correctly made hair belt has not so much stretch as leather of the same thickness, but with an increase of the load it does not approach so near the end of its working load as leather, so that a hair belt can be loaded on a higher scale than leather and still have reserve force to withstand any sudden shock.

The above particulars are given without comments, except that they serve only to emphasize the simplicity, adaptability and reliability of electric motor drive.

## INSULATION BREAKDOWNS.

A new suggestion for the cause of insulation breakdown was put forward by Professor Jamieson in a paper recently presented before the Glasgow (Scotland) section of the Institution of Electrical Engineers. Experiments on the static charges produced by combined bending and friction in certain dielectric substances, especially celluloid, led Dr. Jamieson to suggest the possibility of static charges being produced in electrical machines simply by vibration and rotation, and that cases of insulation breakdown may occur through these causes alone. Static charges are apparently set up in many electrical machines in which there are layers of insulating materials subjected to alternating stresses of bending and pressure combined, as in transformers due to the alternating field setting up vibrations, and in generators due to want of balance and change of flux.

While Professor Jamieson's experiments were by no means exhaustive and his suggestions merely conjectural, the subject is worth investigation and a research might well lead to important results bearing on design.

## THE STUDY OF ILLUMINATION.

The use and abuse of the eye in its relation to kinds of light and systems of illumination have furnished topics for endless discussions. But perhaps out of the somewhat chaotic conditon of the newly-founded science and art of illumination there will soon be evolved a settled order and some well-defined laws and rules on which to work.

That our ideas on correct illumination are at present somewhat hazy is evidenced by the multifarious views that were put forward at a recent prolonged discussion by the Illuminating Engineering Society, of London, England, on the subject of glare. Many of the seeming discrepancies of opinion, however, were occasioned by the fact that the members differed widely in their interpretation of the phraseology of illumination, wherein, it may be noted, lies an opportunity for specialists to standardize their definitions in a manner similar to that recently adopted by the American Institute of Electrical Engineers.

In a recent communication to the above-mentioned society, Dr. Stockhausen gave as his opinion that an excess of radiant energy, of whatever wave length, is injurious to the eye. This, if true, contradicts the commonly accepted supposition that only the red and infra-red rays are dangerous, which Dr. Stockhausen does not believe to be true under ordinary conditions. Certainly these rays occur in sunlight in great quantities, and if direct glare is avoided their effect is not disastrous.

Apropos of this question of light rays in their effect on the retina, an interesting commentary was afforded at a recent public wrestling match in Chicago at which mercury-vapor lamps of high intensity were used for the purpose of enabling cinematograph pictures to be taken of the exhibition. The almost blinding light proved to be very trying to the eyes, and not a few people complained of eye fatigue in consequence. A few spectators, however, who had had the aforethought to provide themselves with eyeshades, suffered no ill effects to their eyes. This is not recorded as a reflection on the mercury-vapor lamp, which has proved its extreme value for many purposes, but only to show the wisdom of avoiding a long-continued glare on the eyes which will prove injurious no matter what may be the source of illumination.

It is sincerely to be hoped that the study of illumination will soon be placed on a sounder basis than it is at present, and that the first step, which might well be undertaken by a national or international commission, will be the exact definition and standardization of an appropriate phraseology. When this is done, any contributions to the literature of illuminating engineering will have a more definite value than they have with the widely diverse standards which obtain at present. The lecture course at Johns Hopkins University, announced last week, is a move in the right direction.

## THE CENTRAL STATION INDUSTRY.

The Department of Commerce and Labor, Bureau of the Census, has in press the special report on the second United States census of the central electric light and power stations for the year 1907, prepared by Mr. Wm. M. Steuart, chief statistician of manufactures in conformity with the act of Congress of June 7, 1906, requiring the collection of such statistics at five-year periods.

The central stations are classed as commercial and municipal, the former being those operated under private ownership, whether by individuals, companies or corporations, and the latter being those operated by state, city or other local governments, except those operated especially for institutions.

The figures given in the report do not represent the entire production of electrical energy. To arrive at the aggregate it would be necessary, it is stated, to consider also the electric railway, telephone and telegraph lines, electrical police patrols, fire-alarm systems, and isolated electric plants.

In 1902 there were 251 railway companies which furnished electricity for light, power and other purposes. These companies reported an aggregate income of $7,703,574 from the sale of current. In 1907 there were 330 railway companies in this class, and the income from the sale of current amounted to $20,093,302.

In 1902 the annual output of all electric stations and electric railways amounted to 4,768,535,512 kilowatt-hours. In 1907 the output of the two classes of stations was 10,621,406,837 kilowatt-hours, the increase as compared with 1902 being 122.7 per cent. In 1902 the output by electric railways formed 47.4 per cent of the total, but by 1907 the proportion for such railways had fallen to 44.9 per cent.

The number of commercial and municipal plants increased from 3,620 in 1902 to 4,714 in 1907, the increase amounting to 1,094 or 30.2 per cent. The application of the same ratio of increase to the estimated number of isolated plants in 1902 gives an estimate of 65,000 for 1907.

These industries represent an outstanding capitalization of $6,209,746,753, of which amount $1,367,338,836 is credited to central stations; $3,774,722,096 to electric railways; $814,616,004 to commercial or municipal telephone companies, and $253,019,817 to telegraph companies, the latter item including $32,726,242, the capital stock of wireless companies.

An interesting commentary on the apparently well-founded belief that the trend of public opinion is away from the establishment of municipal plants is the statement in the report that although thirty-three municipal stations which reported in 1902 had become commercial stations in 1907, 113 stations which were reported as commercial in 1902 had become municipal in 1907. Mere figures, however, can not disguise the evident disfavor into which municipal ownership has fallen.

**Sale of Electric Power Yields Net Profit to Sanitary District.**

The annual report of the electrical department of the Sanitary District of Chicago for the year 1909 has been made public. Its most striking feature is that it shows a net profit of $63,211.46 above all operating costs and fixed charges.

From sales of electric current there was received $383,564, miscellaneous items bringing the total revenue to $391,936. The operating costs of the hydroelectric plant at Lockport, transmission and distributing systems, substations and offices of the electrical department were $143,236. For depreciation there was set aside $40,216. Interest on the investment in the electrical system was $145,273. The total fixed and operating costs were thus $328,725. Additions to the plant, substations, overhead and underground lines amounted to $696,309, which makes the total invested in the electrical system $4,036,599.

The Sanitary District supplies electrical energy to 811 consumers, of which thirteen are municipal bodies. These consumed, however, sixty-seven per cent of the electrical output. The largest consumer is the city of Chicago, which took fifty-six per cent of the output and paid for it $143,184. Next is the West Chicago Park Commission, which paid $15,823. The Lincoln Park Commission paid $6,240. Other cities, villages and public bodies among the consumers are: Morgan Park, Lockport, Blue Island, Berwyn, Cicero, North Berwyn, Lyons and Cook County. The balance of the output was supplied to commercial concerns, there being 695 that purchased current for lighting and 103 that secured it for power.

**Association of Railway Telegraph Superintendents.**

The following papers have been announced for presentation at the coming convention of the Association of Railway Telegraph Superintendents, to be held at Los Angeles, Cal., June 20, 21, 22, 23 and 24.

"Wireless Telegraphy," by William Maver, Jr.

"Education for Efficient Railroad Service," by D. C. Buell.

"Protecting Telephone Lines from Lightning and Other Disturbances," by M. E. Launbranch.

"Automatic Block and Highway Crossing Signaling," by H. P. Ryner.

"Telephone Train Dispatching," by E. E. Dildine.

"Testing of Telegraph and Telephone Circuits," by V. E. Kissinger.

"Telephoning to and from Trains," by E. P. Griffith.

"Composite Telephone Blocking," by W. F. Williams.

Several matters of importance will be discussed at the executive sessions, and a fine programme of entertainments is being provided.

**Annual Meeting of New York Electrical Society—Inspection of New Pennsylvania Terminal.**

The annual meeting of the New York Electrical Society will be held on June 15, at 3 p. m., at the new terminal station of the Pennsylvania Railroad at Thirty-third street and Seventh avenue, New York city. After the election of officers the members will be conducted through the magnificent building. Admission will be by invitation only, arrangements being in charge of George H. Guy, secretary, 29 West Thirty-ninth street, New York city.

**Death of Mrs. P. S. Dodd.**

Philip S. Dodd, director of publicity of the National Electric Lamp Association, has suffered a terrible bereavement in the death of his wife Evelyn (Pratt) Dodd. Mrs. Dodd was a brilliant and charming little woman who had endeared herself to many of Mr. Dodd's friends who were fortunate enough to be favored with her acquaintance. To us of the staff who knew her well it is a sad occurrence. Our deepest sympathies and condolences go out to him who is thus bereft.

**Houston Home Telephone Company Files Mortgage.**

The Houston Home Telephone Company, which plans to establish an automatic telephone system in the city of Houston, Tex., has filed in the County Clerk's office a mortgage for $1,000,000. The document was executed in Chicago by Joseph Harris, president, and Walter I. Patten, assistant secretary. The Mercantile Trust Company, of New York, is named in the instrument as trustee.

**New York Edison Increases Capital.**

The New York Edison Company has certified to the Secretary of the State of New York that it has increased its capital from $45,200,000 to $50,549,400.

**Independents Favor Amendment to Railroad Bill.**

The National Independent Telephone Association is making an active campaign from its headquarters in Chicago against the members of the Senate and House of Representatives regarding the amendment to the railroad bill placing telephone and telegraph companies under the supervision and control of the Interstate Commerce Commission, which the Independents favor as a means of protecting their interests.

**Subway to Jamaica Bay, New York.**

The Public Service Commission will hold a public hearing on Thursday, June 16, on the request of Brooklyn property owners for an extension of the subway south under Utica Avenue and Eastern Parkway.

It is suggested that the line be part subway and part elevated, running to Jamaica Bay. The route would be about three and a half miles in length.

A petition signed by a thousand property owners of the district has been filed with the commission, in which the petitioners agree to pay for the subway on the assessment plan.

**Elevated Tax Reduced.**

Julius M. Mayer, formerly Attorney General, referee to decide what assessment the Manhattan Railway, of New York, should pay on its special franchises for 1907, has filed his report with the New York County Clerk. The report recommends that the total assessment be reduced from $72,000,000 to $51,038,700.

The proceeding was instituted by the people against the State Board of Tax Commissioners, the city of New York being permitted to intervene.

**Consolidated Light and Power Company.**

Announcement is made by the Consolidated Gas, Electric Light and Power Company, of Baltimore, Md., that negotiations have been concluded for the sale of $4,000,000 of three-year five-per-cent gold notes secured by bonds of the company.

**Consider Transfers in Chicago.**

The presidents of Chicago's elevated roads and Bion J. Arnold, the city's traction engineer, met recently and discussed the limit of zones in which transfers are to be given on the loop by the four roads.

### D. C. Jackson.

Professor Dugald Caleb Jackson, recently elected president of the American Institute of Electrical Engineers, represents one of the most progressive types of modern men of science, who, both in academic and commercial attainment, have climbed high on the ladder of achievement.

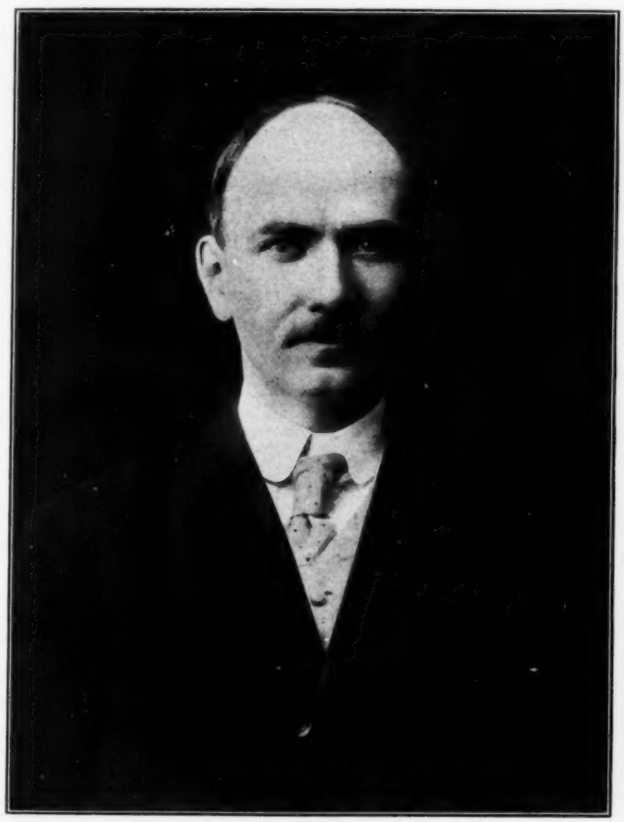
In all around experience and development, the life work of this man is a unique example of the extent to which one can expend a remarkable amount of energy in the building up of a career extended into manifold ramifications.

Professor Jackson was born of Quaker parents at Kennett Square, Pennsylvania, February 13, 1865. He prepared for college at the Hill School, Pottstown, Pa., and graduated at Pennsylvania State College in the commercial engineering course of 1885, having previously spent a year or more on railway surveying and construction. He spent two years at Cornell University in graduate study of electrical engineering.

In 1887 he joined J. G. White and others in organizing the Western Engineering Company at Lincoln, Neb., to build electric railways and electric light and power plants, constructing important electric plants at St. Joseph, Omaha, Salt Lake City, etc., and electric light plants at Kearney, Neb., and numerous smaller places. The plant at Kearney was one of the earlier of the hydroelectric transmission plants of this country, and its operation, which for a time was under Professor Jackson's personal direction, was notable for the number of large (at that time) size motors that were used.

In 1889 the business of the Western Engineering Company was purchased by the Edison interests in New York, and Professor Jackson went to New York to become assistant chief engineer of the Sprague Electric Railway and Motor Company. Later, upon the consolidation of all of the Edison interests, including the Sprague Electric Railway and Motor Company, into the Edison General Electric Company, Professor Jackson went to Chicago to become chief engineer of the Central District of the Edison General Electric Company in charge of the company's construction work in that district. This included electric light and railway plants in St. Louis, Cincinnati, Cleveland, Milwaukee, St. Paul, Minneapolis, etc., and a number of plants of smaller size.

In 1891, Professor Jackson went to the University of Wisconsin as professor of electrical engineering. It was at this time that the department was established at the University, and for fifteen years the development there was entirely under the direction of Professor Jackson.



DUGALD C. JACKSON.
President of the American Institute of Electrical Engineers.

In 1906, Professor Jackson was elected professor of electrical engineering, and head of the electrical engineering department at the Massachusetts Institute of Technology. In addition to his work as an instructor, Professor Jackson has served as consulting engineer on many important developments, and he is the senior member of the firm of D. C. & Wm. B. Jackson, doing a large business in the West as consulting engineers. He has always been a public spirited and useful citizen, and his work in each community of which he has been a member has been of the most substantial character and greatly to the benefit of those with whom he has been associated.

He has published the following books: "Text Book of Electromagnetism and Construction of Dynamos" (1893), "Electricity and Magnetism" (1895), "Alternating Currents and Alternating Current Machinery" joint author (1896), a book on "Electricity and Magnets," joint author (1902). Books on central station practice and complete revisions of his work on alternating currents and alternating current machinery has also engaged his time. He is a prolific contributor to the literature of scientific societies and to the technical press of the country, and has delivered numerous addresses on matters relating to engineering practice or engineering education.

He is a member of the American Institute of Electrical Engineers; American Society of Civil Engineers; American Society of Mechanical Engineers; Western Society of Engineers; Society Internationale des Electriciens; Society for the Promotion of Engineering Education; National Electric Light Association; American Street Railway Association; Northwestern Electrical Association, and others.

He is a member of the Union League Club of Chicago; the Boston City Club; Boston Chamber of Commerce, and the Committee on Public Utilities of Boston.

Professor Jackson's work at Boston, like his great work at Madison, has been attended with great success, and his personal understanding and ability to deal with the complex temperament of the student has endeared him to the host of young men passing through his courses and made him a tower of individual strength to his institution.

Professor Jackson was married to Miss Mabel A. Foss of New Gloucester, Me., on September 24, 1889, and they have two children—a girl and a boy.

## THE BRUSSELS INTERNATIONAL EXHIBITION OF 1910.

BY H. MARCHAND.

Although not especially devoted to the electrical industries, the Brussels International Exhibition, the opening of which took place on April 23, has a peculiar interest for electricians on account of the extensive use which is made of electricity in the various sections of mechanical, industrial, technical and scientific arts.

So numerous are the machines electrically actuated in the different parts of the Exhibition that no less than 7,000 kilowatts are necessary for power alone. Besides this there are numerous electric lamps, their number amounting to 700 arc lamps and 700 incandescents. The latter are more commonly metallic filament lamps, giving from 300 to 2,000 candlepower in clusters. The candlepower of the arc lamps is from 1,200 to 2,000. A powerful searchlight is also exhibited in the German section.

This German section is entirely separated from the other subdivisions and was completely designed and built by German architects, engineers and workmen. It covers no less than 28,500 square meters, as follows: Hall of industry, 18,250 square meters; hall of engines, 5,500 square meters; and gallery of railways, 3,150 square meters, the rest of the space being in some secondary buildings. Tools, bridges, lifts, etc., exhibited in the hall of industry are all electrically driven, the energy being generated by dynamos installed in the hall of engines.

Among the generators the Bergmann Elektricitäts-Werke, of Berlin, are exhibiting one turbo-generator of 12,000 horsepower, one of 2,250 horsepower and the third of 150 horsepower; the two latter alone are operating. The Maschinenfabrik Heinrich Lanz, of Mannheim, Germany, exhibits a 1,000-horsepower locomobile which drives a generator built by the Allgemeine Elektricitäts Gesellschaft; the latter makes no special participation in the Exhibition; however, several of the exhibits installed are equipped with apparatus of this firm.

The engine exhibited by the International Maschinenbau Gesellschaft, of Hanover, is a novel 300-horsepower compound rotary steam engine driving a generator built by the Elektricitäts Aktiengesellschaft vormals H. Pöge, of Chemnitz. There are also suction gas-producer engines, Diesel engines, a 6,000-horsepower marine engine, locomobiles of various types, etc.; most of them do not drive generators. The total capacity of the engines exhibited is 21,000 kilowatts.

Some 3,000 kilowatts are used for power and light; all generators used in this production give direct current. For this purpose steam is generated by two boilers having respectively 500 and 300 square meters of heating surface. The engines work in connection with a cooling tower for condensing purposes. Feed pumps and circulating pumps were installed by representative German firms. Several builders took part in the equipment of the controlling station and switchboard.

France, Belgium, Netherlands, Italy, Switzerland, etc., have gathered their generating units in a common Hall of Engines, which covers 26,600 square meters. However, they exhibit numerous instruments in their respective sections. We noted with much pleasure the fine character of the English exhibits, in which the apparatus was almost all of new design. The Cambridge Scientific Instrument Company, R. W. Paul, etc., have sent valuable measuring and experimental instruments.

The principal generating units in the Hall of Engines are utilized for the production of the current necessary in all parks, buildings, halls, etc., for power and light. Among these are the following ones: A horizontal steam engine driving a 1,000-kilowatt, fifty-cycle, 2,000-volt alternator of the Ateliers de Constructions Electriques de Charleroi.

A turbo-generator of 1,000 kilowatts, forty cycles, 420 volts, is from the works of Brown, Boveri & Company, Baden.

A horizontal steam engine of 900 horsepower by the Société Anonyme du Thirian, La Croyére, is direct-coupled to a direct-current dynamo of 400 kilowatts, 500 volts, of the Société Anonyme Force et Echairage, Brussels.

The fourth unit consists of a direct-current dynamo of 400 kilowatts and 500 volts built by the Compagnie Internationale d'Electricité de Liége, and direct-driven by a 700-horsepower horizontal steam engine of the Société Anonyme des Ateliers van den Kerckhoven, of Gand.

The fifth unit is formed of a direct-current dynamo of 700 kilowatts and 550 volts, built by Ateliers de Constructions Electriques de Charleroi, and direct-driven by a horizontal steam engine of 550 horsepower, made by Zimmerman, Hanrez et Cie, Monceau-sur-Sambre.

The sixth consists of a direct-current dynamo of 400 kilowatts and 500 volts, built by the Felten-Guilleaume-Lahmegewerke, Frankfort, and direct-driven by a horizontal engine built by the Bollinckx firm, of Brussels.

Furthermore, there are some less powerful engines giving 100 to 200 kilowatts. Besides this, there is installed a rotary converter which receives high-tension alternating current from the city mains and gives direct current under a tension of 440 to 500 volts. The distribution is done by a three-wire 440-220-volt direct-current system.

Steam is generated by a battery of ten tubular boilers, with underfeed stokers and conveyors; the boilers have a heating surface of 255 square meters and are capable of evaporating fifty tons of water per hour under a pressure of eleven atmospheres. Four of these boilers produce superheated steam.

Near the main entrance of the Exhibition is situated a substation connected to the city mains, from which it receives high-tension alternating current; the equipment of this substation consists of four 400-kilowatt rotary converters and two 150-kilowatt converters.

### No Overhead Wires for San Francisco.

In a recent opinion on a petition by the San Francisco and Sierra Power Company, City Attorney Long, of San Francisco, Cal., has advised the Board of Supervisors of that city that it has no right to grant to the power company permission to erect electric light and power poles on designated streets. Thus it appears that all wires in San Francisco must be laid underground.

### Railway Exhibit and Conventions in Atlantic City.

The Railway Supply Manufacturers' Association will hold an exhibition of railway appliances, etc., in connection with the Atlantic City conventions of the Master Car Builders' Association (to be held June 15, 16 and 17 next) and the Master Mechanics' Association (June 20, 21 and 22).

# Electrical Developments in Scandinavia.

## Brief Review and an Account of a Three-Phase Railway in Norway.

Owing to its valuable waterfalls, Scandinavia has during the last few years been the field of extensive and important electrical developments. According to the estimates of Lieutenant Libeck, Sweden has some 3,800,000 horsepower available, but only 550,000 horsepower has yet been harnessed, though development is taking place very rapidly, more than half of the utilized power being represented by works which have been undertaken during the last decade. The area of the lakes in Sweden is close on 14,000 square miles, and with its many hills and watercourses and industrial opportunities, the country presents ideal conditions for the electrical and hydraulic engineer to display his specialized knowledge and experience in turning the forces of Nature to useful account in the form of cheap electrical power.

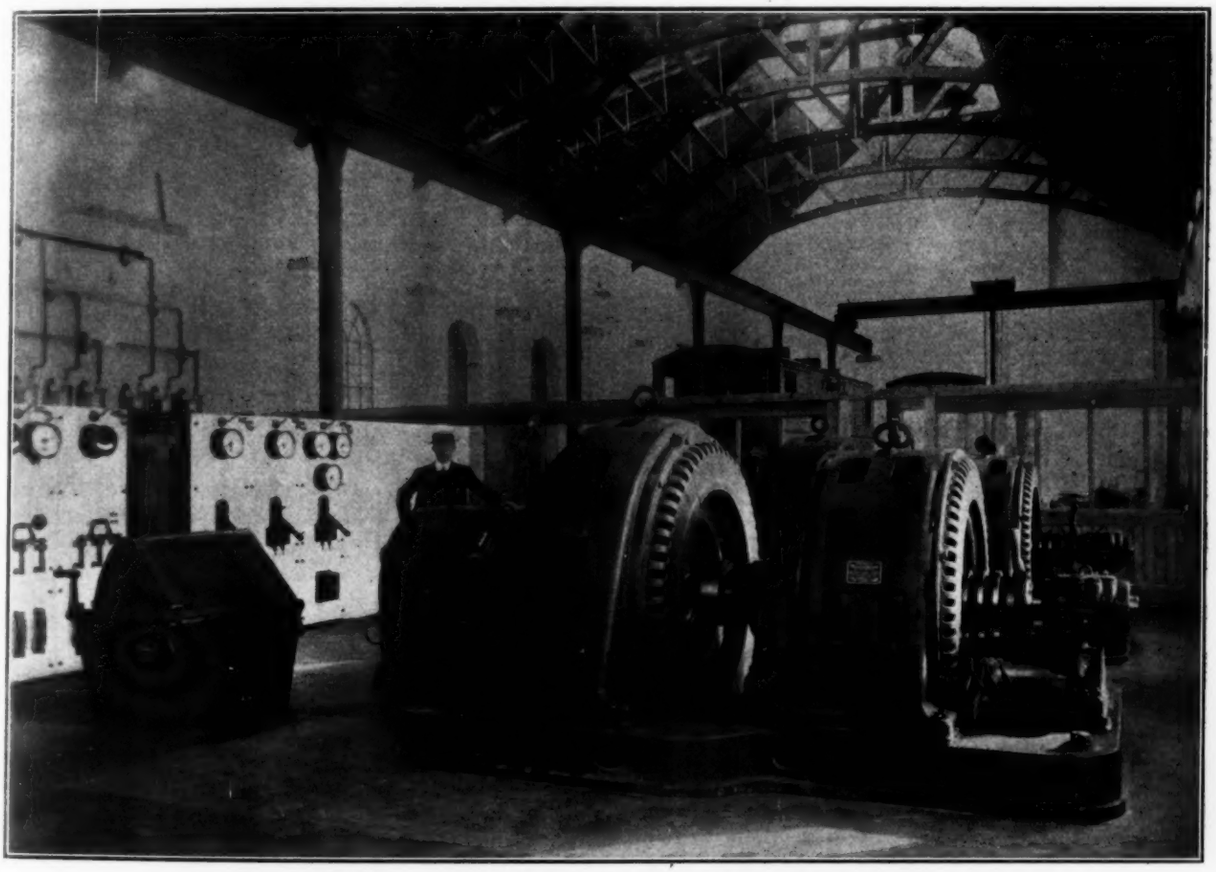


FIG. 1.—MOTOR-GENERATORS IN SUBSTATION AT THAMSHAVN, NORWAY.

In regard to the total available water power, Norway is even better placed, for it is estimated that there there is some 4,800,000 horsepower, only a very small percentage of which had been utilized up to four years ago. In the last four years the rate of progress has been even greater in Norway than in Sweden, so that today each country is utilizing 550,000 horsepower, or over a million horsepower between them. The appreciation of the enormous value of all this power in the development of existing industries and in the establishment and building up of new ones, especially those of an electrochemical kind, has not unnaturally led to Governmental attention, with a view to securing as much benefit as possible to the country, and foreign concessionaires have important conditions to bear in mind in seeking permission for utilization schemes.

One of the noteworthy consequences of recent progress which has required the engineers of Norway and Sweden to specialize in hydroelectric engineering design and equipment has inevitably been the establishing of electrical manufacturing of plant for such installations, and there is little doubt that this factor will soon be observed increasingly in the various countries of the world where up to the present American, German, English and Swiss manufacturers have been the only bidders. Already some of the electrical plant made in Sweden has found its way into Canada and other to the far East. Into the British market at home also, Swedish makers are carrying their efforts.

It is nearly twenty years since the first Scandinavian attempts were made with waterpower plant, but readers who are interested in the history of what has happened since then, will find

it useful to study a paper by Aubrey V. Clayton of the Hydraulic Association of Scandinavia which came before the English Institution of Electrical Engineers in April. It contained detailed particulars of the Alby, Ringdalen Gullspang and Graninge power-stations, the last named (10,000 horse-power), with its 40,000-volt long-distance transmission coming in for the fullest consideration.

An electrical system in Norway which possess features of interest is the Thamshavn-Lokken electric railroad, the first single-phase line in the country. It is a seventeen-mile line serving for various classes of traffic, industrial and otherwise, for it serves both mineral and timber districts and is an attraction for the foreign sightseer. The railroad derives its power from a waterpower station situated in a valley at Skjenald Fossen. There is here a good flow of water all the year round, and the station furnishes electricity for operating mining machinery at Lokken and for lighting supply, as well as for working the railroad mentioned. The load for the railroad is supplied from a substation at Thamshavn which contains motor-generator plant for transforming a 15,000-volt, fifty-cycle three-phase supply down to 6,600-volt, twenty-five-cycle, single-phase current.

In the accompanying illustration are shown the motor-generator plant and the switchboard and high-tension cubicle construction. The substation forms part of the Thamshavn workshops; it is a brick building built on rock. At present there are installed two 15,000—6,600-volt, oil-insulated, three-phase transformers, two 250-kilo-volt-ampere motor-generators and the necessary switchgear. Each motor-generator consists of a three-phase induction motor fitted with slip rings and liquid rheostat for starting, direct-coupled to a single-phase revolving-field generator. An exciter is coupled on the same shaft and all three are on the same bedplate. The line voltage is maintained constant by an automatic voltage regulator. The switchboard is divided into two parts, the operating handles and instruments being mounted on white marble panels, and the high-tension switches busbars, etc., being arranged in concrete cubicles.

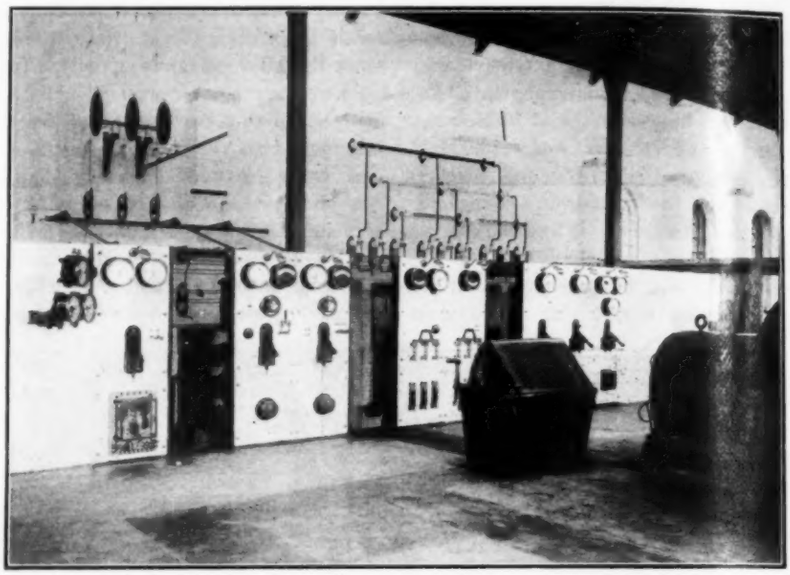


FIG. 2.—THAMSHAVN SUBSTATION, SHOWING SWITCHBOARD AND HIGH-TENSION CUBICLE CONSTRUCTION.

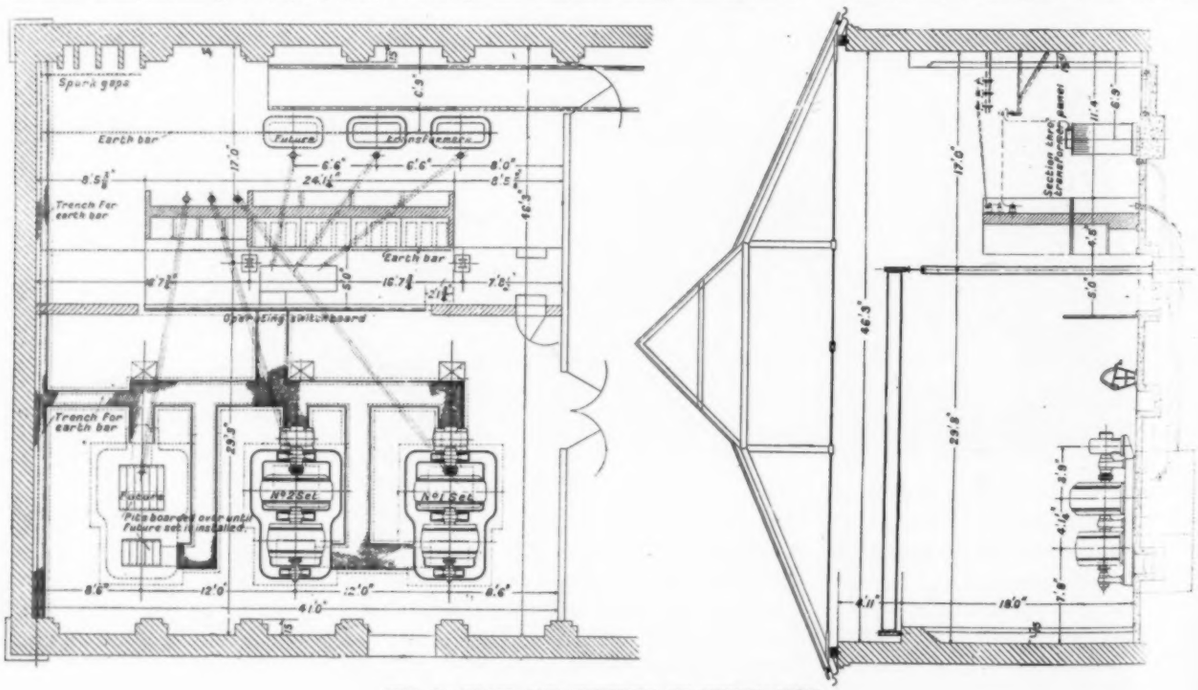



FIG. 3.—PLAN AND SECTION OF SUBSTATION.

# Electrical Notes From Great Britain.

By Our British Correspondent.

The death of King Edward VII. has cast its shadow over everything. Scientific and engineering institutions, as soon as the position was realized, cancelled meetings that had been called. The Tramway Congress, to which reference was made here last month, has been deferred to June 9 and 10. The meeting of the Institution of Electrical Engineers (London) called for May 12, was cancelled, so that the paper by Haydn T. Harrison on "Street Lighting by Modern Electric Lamps," will come on later. The Japan-British Exhibition at Shepherd's Bush, which was to have been opened by the Prince of Wales (now King George V.) on May 12 with the ceremony usual to a great public occasion, was opened without excitement or incident two days later. Some Japanese authorities in London would have preferred that there should have been no opening at all until after the funeral, but it was announced that the new king desired the public mourning to interfere as little as possible with certain forms of public amusement which gave employment to large numbers of workers.

The new electrical organization which has long been trying to establish itself for the purpose of watching over the industrial and legislative interests of electricity in the United Kingdom, has taken unto itself yet another name, and with its new name has abandoned some of its earlier ideas, among which was the proposal to admit shareholders in electrical companies as members on payment of sixty cents, whether they knew anything or nothing about affairs electrical. The members will each subscribe one guinea per annum and are for the most part men of authority. Whether even in the present shape the "Committee for the Protection of Electrical Interests," as it is now termed, will satisfy those who were disinclined to support it in its earlier stages, it is difficult to say.

The British Westinghouse Electric and Manufacturing Company, which has just held its annual meeting in London, is able to show improved results on its trading for the past year, the loss being only some $4,000, as compared with $32,600 for 1908. These figures, however, do not tell the full story, for the 1908 loss would have been far more but for a large sum brought forward from 1907. The actual improvement for 1909 is over $85,000. J. A. Bryce, the chairman, told shareholders that the company held $1,000,000 in the Clyde Valley Power Company. It went in for this venture in order to secure a large order for the works, but these big power schemes were all taking a long time to develop. The Clyde Valley, however, he said, had now turned the corner and was beginning to make profits, so that before long they might realize the value placed upon the security. The British Westinghouse Company was handicapped by having works much too large for the amount of business available. The depressed state of trade in 1909 caused a falling off of about six and one-half per cent in orders as compared with 1908. The company was doing a fair amount of business abroad.

The Clyde Valley is not the only big power company that is at last showing welcome improvement in its position. The South Wales Power Distribution Company, whose past has been so singularly unfortunate, reports that for the first time in its history there is not a loss on the year's working. The Treforest Company with which it has a working arrangement, has made steady and sure progress, its output having increased from 7,645,125 units in 1908 to 9,833,038 units in 1909. During the year, in the Treforest area an additional 1,300 horsepower was connected, making, with the consumers in the Cwmbran area, a total of 9,825 horsepower. The Great Western Colliery Company is going to take the entire supply for the new colliery it is sinking at Llantwit Vardre. The Lewis Merthyr, the Albion, and Lockett's Merthyr colliery companies are also all making considerable additions to their installations. The Treforest Company has to raise capital for extending its generating plant to meet these and other large demands. It is said that there never was a more favorable opportunity for booking big consumers in this area than there is just now, and altogether the South Wales Power position shows better prospects.

Another power venture which passed the parliamentary and paper stages some years ago but has had to be pigeonholed until now in consequence of the unwillingness of the public and financiers to find money for new electrical securities, is being looked at again and with greater hope on the part of the Urban Electric Supply Company, to which the valuable powers belong. As a field for power supply Cornwall is considered to hold out bright prospects. According to P. D. Tuckett, the Urban Company's chairman, "there are many thousands of horsepower within a radius of a few miles and although the Cornishman is somewhat cautious in his adoption of new methods, electric driving is coming to be regarded with steadily increasing favor." A contract has recently been entered into for a considerable supply of power to Dolcoath mine, the premier mine of the district, and there are other big inquirers, while the South Crofty & East Pool mines are already connected. There is also other business, besides mine supply, waiting in the Redruth district. By means of another generating station on the coast, sixty cents per ton on coal will be saved, and better condensing-water facilities will be available. The Cornish tin mines are doing far better than they were, and it is said that when once the electricity suppliers get the cables to the mines they will be welcomed by the mine engineers with open arms.

Some of our municipal authorities in their efforts to make their electrical and tramway departments work at a profit, are like a poor man struggling with adversity. The Corporation of Oldham is reporting a loss of $15,000 on its tramways in 1909, bad trade being blamed, and it is stated that this is the only line in the country earning nearly a shilling a mile, that does not pay. The Newcastle-on-Tyne Corporation has laid out a capital of over $5,000,000 upon its trolley lines, and on that outlay there was in the year 1908-9 a clear profit of only $2,000, for the paper profit of $37,500 was absorbed to the extent of $35,500 in expenditure renewals. That result has been improved upon during 1909-10, for though there was a small decrease of $870 in income, there was a reduction of $25,000

in working expenses. The Heywood municipal trolley lines showed a loss of about $6,000, practically the same as in the preceding year, but the electricity supply department turned a loss of $440 into a profit of $620. Bournemouth Corporation tramways with receipts of $428,000, had a loss for the year of $11,100 against a loss of $27,000 in the previous year. Bournemouth is the only town in England, except London, where the conduit system is employed; the central parts of the town are equipped in that way, all other lines having the overhead trolley. It is now proposed that these conduit sections, which, it is said, added some $250,000 to the cost of construction, be converted to trolley working. The cost of the equipment necessary for the change is estimated at under $10,000, but the manager states that the conversion would result in a saving of $15,000 per annum in working expenses. The City of Birmingham is in a far more fortunate position than the smaller places alluded to above, for its profits on its trolley lines for the year amounted to over $282,000 (net), $165,000 of which is being placed to the relief of rates. This relief is $17,500 more than in the previous year, and it has been obtained in spite of the fact that a rearrangement of the employes' working hours resulted in an increase of $40,000 per annum in wages. Birmingham, like some other towns, experienced a general improvement in traffic during the closing months of 1909. Nelson Corporation tramways showed a net loss of $3,855. Part of the system has been operating for seven years and the manager has advised that the undertaking cannot be a financial success until one-cent fares are abolished. The electricity department of the same town incurred a loss of $650, though it expected a profit of $1,300. Huddersfield municipal trams with an income of $450,000 and working expenses of $237,000, after meeting all financial charges and allowing three per cent depreciation, had a net profit of $34,000 which has gone to relieve rates. Leeds Corporation had an exceptionally good year and is relieving the rates by some $275,000 from its tramway profits. Manchester tramway receipts amounted to $3,886,000 for the year, an increase of $16,000, and this system has since its commencement relieved the public rates by $2,250,000. The London County Council tramways (including a few horse lines) produced during the year ended March, 1910, $9,840,000, an increase of $835,000.

Among the papers read before the Institution of Electrical Engineers during the past month, is a useful study on the "Standardization of Fuses," read at Birmingham by H. W. Kefford, who dealt with the subject from a practical point of view. The results of tests on commercial fuses were considered in conjunction with corresponding theoretical indications, and definite deductions were drawn as to the most suitable quantitative and structural properties for a standard line of fuses. Mr. Kefford's tests have up to the present been confined to low-tension fuses up to a normal carrying capacity of about sixty amperes, but he hopes to continue the experiments on fuses of much larger capacity. The following rules were followed in all the author's tests, these constituting an adequate and not too severe short-circuit test for fuses up to fifty amperes rating:

(1). The source of current should be a battery having an open-circuit potential difference ten per cent higher than the rated maximum voltage of the fuse under test, and capable of giving 500 amperes without the terminal voltage dropping by more than five per cent.

(2). The total resistance of the test circuit including the fuse should be adjusted to correspond to a steady current of 1,500 amperes produced by an electromotive force equal to the rated maximum voltage of the fuse.

(3). On closing the main switch the fuse should blow without a continuous arc being formed or any explosive violence.

Mr. Kefford put forward suggestions as a basis for the discussion of a specification for standard fuses. These were as follows:

(*a*). *Material for Fuse Wire.*—The fuse wire must not corrode or permanently change its conductivity or physical structure.

(*b*). *Non-interchangeability.*—Fuses up to fifty amperes rated current should be provided with a simple arrangement by means of which the capacity of the fuse which can be inserted by a nontechnical user is restricted within definite limits.

(*c*). *Type of Fuse Recommended.*—To facilitate compliance with (*a*) and (*b*) above and generally to render standardization practicable and useful, an inclosed cartridge type of fuse is recommended.

(*d*). *Indication of Fusion.*—All fuses must be provided with a simple means for detecting fusion simply by inspection of the fitting.

(*e*). *Rating.*—The rated current marked on the fuse shall bear a definite relation to the limiting current or least current which will produce fusion within four hours. The minimum value of the ratio limited current to rated current shall be 1-54, and the maximum value shall not be higher than thirty per cent, above the minimum. In a correctly proportioned line of fuses this ratio should decrease from the maximum to the minimum values specified, as the size of the fuse increases from the lowest to the highest capacity. This regulation is based on the assumption that silver is the best metal for fusible links, taking into consideration its permanent character, the small volume required, and its "clean" action when breaking the circuit.

(*f*). *Sluggishness of Action and Time Element.*—Standard fuses shall be so rated and constructed that when loaded with fifty per cent above the limiting current they will fuse within one minute.The actual time required for fusion shall be taken as a measure of the "time element" of the fuse.

(*g*). *Standard Rated Currents and Voltages.*—Every fuse shall be clearly marked with its rated current and the maximum voltage for which it is suitable. The standard rated currents and voltages suggested are as follows:

Maximum Voltage, 250.—Two, four, six, and ten amperes.

Maximum Voltage, 500.—Two, four, six, ten, fifteen, twenty, thirty, forty and fifty amperes.

(*h*). *Temperature Rise.*—When loaded continuously with eighty per cent of the limiting current no exposed part of any fuse fitting shall attain a temperature exceeding 100 degrees centigrade above that of the atmosphere.

(*k*). *Insulation.*—Fuse fittings shall be tested for insulation between terminals with the fusible portion removed and between the live parts and "earth" with the fusible portion in place.

(*l*). *Operation.*—Fuses shall be tested for satisfactory operation on overload and short-circuit in accordance with the specified arrangements for carrying out such tests.

The annual meeting of the Institution of Electrical Engineers called for Thursday, May 26, is the closing event of the 1909-1910 session. Among the business coming before that meeting are certain financial arrangements connected with the completion and equipment of the new home of the Institution. When the meetings recommence next November, it will be with S. Z. de Ferranti as president in place of Dr. Gisbert Kapp, whose year of office is drawing to a close. Probably before this year is out, the Institution may be lodged in the new building—the realization of a long-cherished ambition.

After very many discussions in the form of articles and correspondence in the technical press, electrical men connected with the electrical industry of the United Kingdom assembled at Caxton Hall, Westminster, by invitation of the National Electrical Manufacturers' Association, to take part in a debate on the effect of "Free Trade" and "Protection" upon the Electrical Industry. J. E. Kingsbury, who has had many years of close experience with the industry, and who recently relinquished his important office with the Western Electric Company (London and North Woolwich), opened the debate from the free-trade point of view. Previously an admirable exposition from his pen in one of the electrical journals drew praise from advocates on both sides.

The "protection" case was put to the meeting by one of its leading champions in the electrical world, Hugo Hirst, of the General Electric Company, Ltd., a co-worker with G. Byng, who has argued for tariff reform in season and out of season, for many years past, his conviction and zeal even bringing forth a book on the subject which has been widely read and frequently quoted. Allusion to the debate may be made later.

ALBERT H. BRIDGE.

London, May, 1910.

### Canadian Electrical Association.

Arrangements for the twentieth annual convention of the Canadian Electrical Association, to be held at the Royal Muskoka Hotel, Muskoka Lakes, July 6, 7 and 8, are rapidly being completed. Present prospects are that the attendance will be the largest in the history of the association.

The Papers Committee has secured a number of excellent papers, among which is one on the subject of "Rates" by S. Bingham Hood, of the Toronto Electric Company. Topics covered by other papers will be announced later.

The Committee on Uniform Accounting has considered very carefully the various systems in use, both in the United States and Canada, and will make a comprehensive and complete report.

The Committee on the Care and Testing of Meters has also been very active, and will have an interesting report of its deliberations.

The members of the General Convention Committee are as follows: W. L. Adams, P. S. Coate, R. G. Black, R. F. Pack, W. A. Burke, T. F. Dryden, W. M. Andrew, T. J. Lynch, T. R. Fulton, Geo. C. Rough, A. L. Mudge, Valentine Boyd, C. H. Mitchell and T. S. Young.

### Abandoned Tracks in New York.

One of the problems with which the Reorganization Committee of the New York city Metropolitan lines has to contend is the disposal of unusued or abandoned street-car tracks. There is about twenty miles of unused trackage, nearly all constructed for horse-car operation, and this could not be electrified at a cost of less than $40,000,000. On the other hand, the bankers who are backing the reorganization are opposed to letting the lines go back to horse-car operation.

## AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

PROVISIONAL PROGRAMME FOR ENGLISH MEETING IN JULY.

A letter of detailed information covering all matters relating to the English meeting of the American Society of Mechanical Engineers has been issued to all who have signified their intention of being in attendance there and particulars can be secured from the secretary on request, by all who may be interested.

The party leaving New York on the official steamship Celtic, Saturday, July 16, at 2 p. m., will arrive in Liverpool Monday morning, July 25. Passengers will have a few hours for recreation on shore and will leave at noon by special train, for Birmingham, where they will be officially received by the (British) Institution of Mechanical Engineers.

The committee of the society in charge of the arrangements is composed of Ambrose Swasey, chairman, Charles Whiting Baker, vice-chairman, W. F. M. Goss, Geo. M. Brill, John R. Freeman and George Westinghouse, Wm. H. Wiley, F. R. Hutton, Willis E. Hall, Calvin W. Rice, ex-officio.

The provisional outline of the meetings follows.

BIRMINGHAM PROGRAMME.

*Monday, July 25. Afternoon.*—Arrival in Birmingham.

*Tuesday, July 26. Morning.*—The Right Hon. the Lord Mayor of Birmingham and the Members of the Local Committee will receive and welcome the president, George Westinghouse, and the officers and members of the Aspinall, and the council and memneers, and the president, John A. F. Aspinall, and the council and members of the Institution of Mechanical Engineers.

Reading and discussion of papers.

Luncheon in the Town Hall.

*Tuesday Afternoon.*—Visits to Stratford-on-Avon, Worcester, Gloucester, or Bournville; and local works.

*Tuesday Evening.*—Garden fete.

*Wednesday, July 27. Morning.*—Reading and discussion of papers.

Luncheon in the Town Hall.

*Wednesday Afternoon.*—Visits to the University and local works.

*Wednesday Evening.*—Reception in the Council House, by invitation of the Right Hon. the Lord Mayor of Birmingham.

*Thursday, July 28.*—Visits to works in Coventry and Rugby; also to Warwick, Leamington, Kenilworth, or Lichfield.

LONDON PROGRAMME.

*Thursday, July 28. Afternoon.*—Arrival in London.

*Thursday Evening.*—Conversazione at the Institution.

*Friday, July 29. Morning.*—Papers on Electrification of Railways.

*Friday Afternoon.*—Garden parties at private houses.

*Friday Evening.*—Institution dinner in the Connaught Rooms, Freemason's Hall, Great Queen Street, W. C. (including ladies.)

*Saturday, July 30. Morning and Afternoon.*—Excursion by rail and river to Windsor and Henley (by invitation).

*Saturday Evening.*—Reception at the Garden Club in the Japan-British Exhibition at the White City, Shepherd's Bush, London.

### United Railways Investment.

The United Railways Investment Company, which controls the United Railways of San Francisco, with more than 250 miles of trolley lines, has filed a certificate with the Secretary of State of New Jersey, increasing its capital stock from $50,000,000 to $56,000,000. The increase was made by the issue of $6,000,000 common stock, making the total stock authorized $25,000,000 preferred and $31,000,000 common.

### Hydraulic Power Company of Niagara Falls Increases Capital.

The Hydraulic Power Company, of Niagara Falls, has certified to the New York Secretary of State that it has increased its capital stock from $500,000 to $12,000,000. The stockholders of the company include: Arthur Schoelkopf, Jacob F. Schoelkopf, George W. Olmsted, George B. Matthews, Paul A. Schoelkopf, G. P. Hugo Schoelkopf and Hans Schmidt.

### Interurban Property in Indiana.

The State Board of Tax Commissioners has placed the valuation of the property of interurban roads at $22,384,027, an increase in the electric propers of $847,986 over last year. This includes main track, side track, rolling stock and improvement right-of-way.

## AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

MEETING UNDER AUSPICES OF RAILWAY COMMITTEE.

A special meeting of the American Institute of Electrical Engineers was held in the auditorium of the Engineering Societies Building, New York city, on Friday evening, May 27, 1910. William McClellan, the chairman of the Railway Committee, presided at the meeting and two papers were read, dealing with subjects connected with electric railways.

PORCELAIN STRAIN INSULATORS.

The first paper was "The Application of Porcelain to Strain Insulators," by W. H. Kempton.

Porcelain has the advantages that it can be made in any shape, does not deteriorate, has high electric strength, and is not affected by frost. Its disadvantages are low tensile strength and lack of resiliency. It has fair shearing strength and good compressive strength and these make it available for strain insulators. Tests were made on actual insulators to determine breaking strength, ten samples being used. The average breaking stresses were, for tension, 654 pounds per square inch; shear, 2,400 pounds per square inch; compression, two forms of specimen, 12,690 and 16,370 pounds per square inch, respectively. The individual variations were large, the minimum values being about three-fourths of the average values. The spool, loop and barrel types were next considered individually, and the design of an ideal insulator given. The load-bearing portion of this has two exactly parallel surfaces held between two exactly parallel and rigid plates. A spool form of insulator has been made of 5.5 inches diameter and twenty-four inches long which withstands a mechanical stress of 34,000 pounds, and an electrical test of 80,000 volts. It has been shown that high mechanical stress does not weaken the porcelain electrically. For low-voltage work, the "goose-egg" insulator has proved reliable. This is an oval mass with grooves in each end at right angles to each other. Moulded insulators have proven more popular on low-voltage work, but are not suited to high voltage. They have also the disadvantage of depreciation from exposure. Wood strain-insulators have also become popular.

CATENARY TROLLEY CONSTRUCTION.

This was followed by a paper by W. N. Smith on "Electric Railway Catenary Trolley Construction."

Since 1904 catenary construction has come into extensive use for electrified trunk lines and interurban railways. Although originally installed for single-phase operation at 2,200 volts, it is now used even for direct-current lines and at various voltages from 600 to 11,000. The principal features combined in this construction are the flat and smooth alinement of the trolley wire for high speed, the prevention of a trolley wire falling to the ground when broken, which is imperative with high potentials, and the use of a pneumatically-operated sliding bow for making contact, which dispenses with the trolley rope, avoids the necessity of frogs at switches and will stay on the wire at any speed regardless of the swaying of the car. However, there has been a tendency to retain the use of the wheel trolley even in 3,300- and 6,600-volt lines. If the catenary line is put up with too much slack in the trolley wire it causes sufficient sag in ten-foot sections to make kinks at the hanger points and thus cause flashing and sparking with the sliding bow. There are three common types of catenary construction: 1. The original and most common is the plain single catenary, with the trolley wire hung directly from the messenger wire. 2. The compound or three-wire single catenary, in which the trolley wire is suspended by clips of uniform length from a tight secondary wire just above it, this secondary wire being supported by hanger rods of varying length from slack messenger wire above it. 3. Double catenary construction, consisting of two messenger wires and one trolley, the latter below and between the other two, the three wires being at the corners of an equilateral triangle and rigidly connected by triangular pipe spreaders varying from six inches to six feet on a side according to the sag of the messenger wire. This is the New York, New Haven & Hartford Railroad construction and, as it has been found too rigid, has been modified by the suspension of an auxiliary working conductor directly below the trolley wire and supported from it at points midway of each ten-foot section between hangers. The second type of construction is used considerably in Europe for single-phase lines Where wooden poles are used they should be invariably treated, at least at the butt end, with some good preservative agent. Steel poles are obtainable in three forms: the second or third section tubular pole, the "tripartite" sectional pole, and the "diamond" pole. The author thinks the tripartite poles have the advantage of being "paintable" at every point. Reinforced concrete poles have been used to a limited extent only. Porcelain petticoated insulators are now used almost invariably. The expense of steel bridges for supporting catenary trolley wires over more than two or three adjacent tracks can be greatly reduced by using span-wire construction. The trolley wire is supported by suspending from the span wire a stirrup of tee iron. Brackets and span wires should be entirely grounded. A light steel bridge construction has been used with spans of 300 feet and plain single catenary without any special adjustment or tension devices. Messenger cables of 500,000 circular-mil copper are used with these bridges and form the feeders of the line. This elimination of special messenger cables and making the feeders serve this purpose, along with the light bridges, has made this construction quite economical. For messenger wires seven-strand steel cables are generally used. The trolley wire is usually No. 000 or 0000 B. & S. hard-drawn copper. As the elastic limit of the latter is dangerously near the tension that is liable to be attained in winter, it is necessary to use "phono-electric," copper-clad steel or steel wire. These wires can easily stand the tension of 5,000 pounds to which they will be drawn in cold weather to insure absence of slack in the trolley wire during summer. In Europe, tension devices and flexible devices are generally used, but they have not found favor in this country. The excellent service rendered by the steel trolley wire on the New Haven system has suggested to the writer to use it with a copper messenger wire. Many designs of catenary hangers have been brought out. The desirable features that should be incorporated in them are simplicity, flexibility, certainty of grip, speed of application and adjustment and cheapness. A minimum number of lengths of hangers is also desirable to reduce the varieties to be kept in stock. There is a notable tendency to increase the distance between hanger points. Staggering the trolley wire from side to side of the center of track has not been found necessary to spread out the wear on sliding bows. The latest design of heavy catenary construction by the New Haven line has many marked advantages. Various types of steady strain insulators and pull-offs are used. Porcelain is becoming more common for strain insulators. The best form of section insulator is the overlapping break. The author of this paper is inclined to the opinion that the roller type of pantograph trolley has distinct advantages over the sliding bow and that it is quite likely to see such development in the not distant future as to permit its use in the heavy service of electrified trunk lines. In conclusion he points out that the complications in the overhead work with all double trolley systems have not only prevented their use in this country, but have hindered the development of three-phase lines as well.

In opening the discussion, P. H. Thomas spoke of the great value of definite figures for porcelain, as given in the first paper. In the suspension type of insulator, porcelain is used in its weakest form, and this matter should receive attention. Another point requiring attention is as to the relative behavior of porcelain from different manufacturers. Security in railway work can be obtained by allowing a proper margin of safety. On some high tension lines it has been noticed that the petticoat type of insulator was shattered by lightning without puncturing the material. It seemed like a mechanical shock.

C. J. Hixon stated that while the date 1904 might apply to the first catenary construction in this country, there was some in operation in Germany in 1903. Vertical flexibility is the keynote of successful collection of current from a trolley wire. The collector, in passing along the wire, should not only take up the sag but also raise the hanger a couple of inches to a floating position, thus eliminating the blow which would be given to a rigid support. This flexibility compensates somewhat for the inherent sluggishness of the roller pantagraph. With this flexibility, low tension in the wire and low pressure of the trolley, all strains are reduced and the cost of maintenance is decreased. On curves the pole spacing may be greater than given by Mr. Smith if pulloffs are properly located.

R. D. Coombs considered it unnecessary to keep the trolley wire horizontal, since the track itself is not a plane. The question of flexibility is as yet open. The Germans find a secondary catenary entirely successful, but their speeds and train-loads are less than our own. He has found a single catenary with a very light hanger satisfac-

tory. A stiff and strong trolley wire, say steel with copper feed wire, would be worth trial in this connection. Such a steel wire has been used on the New Haven installation.

L. S. Thurston told of troubles with slack wire and breaks and Charles Hart discussed rigid and flexible track and trolley wire. It is undesirable to have hard spots in a soft line or soft spots in a rigid line, for either will make trouble. He described a modified pantagraph, and a special hanger. Speaking of clearance, he declared eight feet to be too little.

W. H. Kempton, replying to Mr. Thomas, expressed the opinion that the broken insulators were not caused by electrical stresses, but by heat from an arc. He also advocated large clearance and lining up trolleys on curves.

William McClellan predicted that practice would finally resolve itself into the use of a cable suspension between poles carrying the catenary and the elimination of all hard spots.

W. N. Smith, in closing, expressed a preference for the roller pantagraph over the sliding pantagraph.

### Railway and Lighting Deal in the South.

In connection with the purchase of the Salisbury and Spencer railway and lighting properties at Salisbury, N. C., by the Piedmont Railway Company, it is stated, says the *Manufacturers' Record*, that the new owners will make extensive improvements to the gas plant, extending mains and otherwise enlarging it. This is the company which is constructing a street railway in Concord, N. C., and it is anticipated now that the contemplated interurban road between Concord and Salisbury will soon be completed.

The property purchased includes an electric railway from Spencer via Salisbury to Fulton Heights Park, the electric-light system of both Spencer and Salisbury and the gas works of Salisbury, which supply both that city and Spencer. The properties were bought from the firm of Edward Dean & Company, bankers, Grand Rapids, Mich.

The officers of the Piedmont Railway Company are: W. F. Snider, president; T. H. Vanderford, vice-president; T. J. Jerome, secretary. M. L. Jackson, of Salisbury, and T. D. Maness, of Concord, are also interested.

### Programme of the Annual Convention, American Institute of Electrical Engineers.

The twenty-seventh annual convention of the American Institute of Electrical Engineers will be held at Jefferson, N. H., June 27, 28, 29 and 30, 1910.

The Institute headquarters during the convention will be at the Waumbek Hotel. The convention sessions will be held in the hotel.

The programme by sessions is as follows:

*Monday, 2 p. m.*—(1) President's Address, Lewis B. Stillwell; (2) Headlight Test, by C. Francis Harding and A. N. Topping; (3) Light Standards, by Edward B. Rosa; (4) Modern Oil Switch, by A. R. Cheyney.

*Tuesday, 10 a. m.*—(5) Disruptive Strength with Transient Voltages, by Charles P. Steinmetz and J. L. R. Hayden; (6) The Electric Strength of Air, by John B. Whitehead; (7) Vector Power in Alternating-Current Circuits, by Arthur E. Kennelly; (8) Determination of Transformer Regulation Under Load Conditions and Some Resulting Investigations, by Adolph Shane.

*Tuesday, 8 p. m.*—(9) American Telegraph Engineering. Notes in History and Practice, by Wm. Maver and Donald McNicol; (10) Telephone Engineering Around the Golden Gate, by Arthur B. Smith; (11) Interaction of Fly-Wheels and Motors When Driving Roll Trains by Induction Motors, by F. G. Gasche; (12) Recent Progress in Exact Electrical Measurements. By Clayton H. Sharp and W. W. Crawford.

*Wednesday.*—No sessions; trip to Mount Washington. Wednesday evening at 6 o'clock there will be a dinner and discussion by the Sections Committee and Section delegates.

*Thursday, 10 a. m.*—(13) Electric Locomotive Design, by N. W. Storer and Eaton; (14) A Method of Determining the Adequacy of an Electric Railway System, by R. W. Harris; (15) Third Rail Construction, by Jesse H. Davis; (16) Power Economy in Electric Railway Operation—Coasting Clock Tests on the Manhattan Elevated Railway, by H. S. Putnam.

Thursday evening there will be a dinner.

### Copper Exports.

Exports of copper for the month of May were 20,832 tons compared with 31,423 tons the same period last year.

## AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

MAY MEETING OF THE PITTSBURG SECTION.

A Kink Meeting was held by the Pittsburg Section of the American Institute of Electrical Engineers at the Lecture Room of Carnegie Hall, Pittsburg, Pa., on the night of May 10. This meeting consisted of short talks on new methods or short cuts by a number of engineers representing various industries connected with the electrical profession.

H. A. Pharo of the Pittsburg Railways Company gave some interesting notes on repairs made on a burned commutator on a generator which was out of circuit only fifteen minutes. A large hole which had been burned in the commutator was filled with plaster of paris, dried out and the generator cut in service again. He also stated that the Pittsburg Railways Company maintained a portable unipolar generator driven by a Westinghouse type "G" direct-current motor, mounted on an Adams express truck, the set being taken to various points in the district to calibrate meters and to make tests. The generator delivers 10,000 amperes at a low voltage. He also mentioned that commutators are turned up while the machines are being operated as motors by their own power. Usual cases of rough commutators are smoothed up by the use of a sandstone prepared for the purpose.

A method of determining the degree of good contact existing in brush type circuit breakers consists in placing a sheet of good grade tissue paper on the contact and then closing the breaker. When the breaker has again been opened the tissue paper will show what portion of the contact was poor.

K. C. Randall of the Westinghouse Electric and Manufacturing Company, by means of several diagrams, showed how various groupings and connections of service transformers of different capacities and ratios could be worked out to give many useful combinations to deliver powers at required potentials in cases of emergency, and still load the transformers properly.

Ralph W. Atkinson of the Standard Underground Cable Company gave some valuable information regarding the properties of insulating gums and compounds and results from testing

the viscosity with a viscosimeter. By means of the tests and the determination of the brittleness he is able to classify compounds for various purposes since his experience shows him that those compounds which are brittle become soft rapidly with rapid changes of temperature. By these classifications one can determine what insulating compound to select for use in impregnating, bearing in mind that the brittle compound will crack when subjected to sudden shocks.

Henry W. Fisher, also of the Standard Underground Cable Company, described a new method of measuring the viscosity of compounds, with apparatus consisting of a simple steel cylinder bored with holes to hold the compound and the thermometer. This cylinder is so designed and operated that there is very little uncertainty about the temperature at which the compound melts. The uncertainty in this regard as measured by the apparatus used by Sanborn, is his chief objection to that method and the value in the device suggested which can be made and used by anyone having any amount of mechanical ability.

F. E. Wynne, who is connected with the Westinghouse Electric and Manufacturing Company, gave some short methods for quick calculation of the necessary conductors for street-railway service, both alternating current and direct current.

F. K. Singer of the Central District and Printing Telegraph Company showed a typical trouble diagram of a telephone system with a view of exemplifying how any trouble in electrical circuits could be reduced to a system by a trouble diagram and then systematically studied out until by making certain tests and comparing the results with the trouble diagram, the defective element could be easily located with the least difficulty and delay.

In the discussion which followed the papers Henry Fisher described by request the new insulating material called "Bakelite," made by Mr. Baekeland and described at a recent meeting of the American Electrochemical Society held in Pittsburg, May 7. Samples of the material were shown and a statement made of the method of manufacture from phenol and formaldehyde.

**Lewis Institute Branch of American Institute of Electrical Engineers.**

On the evening of June 3, Robert R. McCormick, president of the Board of Trustees of the Sanitary District of Chicago, spoke before the Lewis Institute Branch of the American Institute of Electrical Engineers in the Assembly Hall of Lewis Institute, Chicago, on the power situation of the city.

Mr. McCormick, who has been prominent in political circles in Chicago, spoke briefly of the difficulties which he, as a business man, had encountered in offering his suggestions to the purely technical engineers of the Sanitary District, and of some of the business and technical problems with which he had to deal.

Regarding the question of municipal ownership he has, since the time of his service as an alderman, been strongly opposed to this, and, speaking as the president of the Sanitary District, his views are still the same. It is to be regretted that private-owned plants have in the past been so intimately connected with politics. Should municipal ownership become universal at any time, it will not be because private ownership is not satisfactory, but because private capital has been such a forceful cog in corrupt politics.

Our constitution, either of the United States or of the separate states, did not contemplate the great development in the manufacture of machinery which has since taken place, and the fact that this was not foreseen has limited the progress of industry to a considerable extent. Municipal ownership abroad is not so limited, because the constitutional limits are not fixed. It is rather interesting to remember that the first railroad which was granted a franchise in Chicago was given this franchise with the express understanding that the road could be taken by the city at any time.

Regarding the private ownership of any public service, it is difficult to state what utilities should be under this method of management. It is possible to conceive of a fire company which is managed and owned by the insurance companies, the running expenses being paid by the premiums of those insured. Water companies naturally fall under the head of municipally-owned bodies, but there are a number of these which are privately owned and are operated successfully. The situation might resolve itself as follows: The public has fixed ideas, and is rather opposed to having utilities, which are at present operated municipally, given over to private management, and vice versa, to having privately-owned corporations managed by the government.

The question of sewage should, quite naturally, be solved by the public, or a public-service body, and it was with the object of the disposal of sewage in view that the Sanitary District was formed. The supply of electric power was at first a secondary question. In fact, it was not until the Sanitary District had been in existence for a number of years that steps were taken for the generation of electrical power.

As a drainage canal the one serving Chicago is the most remarkable in the world, and its success is due to the fortunate selection of engineers, and largely owing to Mr. Hering. It was suggested at first that the power rights be leased to some operating company, which the Sanitary District had no part in managing, and there is much to be said in favor of leasing this power. There was, however, no purchaser who was willing to pay a sufficient price, and three years after the canal was opened up steps were taken to build a hydroelectric plant to be operated by the Sanitary District. The plant was finished in January, 1908. At first some opposition was brought to bear against selling this power in Chicago, but this was overruled in a short time. At present a contract is pending between the Sanitary District and the city of Chicago to the effect that the District shall take over all of the 12,000-volt lines of the city and is to loan the city the money necessary to install adequate street-lighting systems. The Sanitary District will overlook all of the high-tension lines and the city will superintend the trimming and will look after the proper burning of the lamps.

There is very much to be done in unification of the power supply both in Chicago and suburbs, for with the present system there is much duplication of generating machines, boilers and transmission lines that might be eliminated. As a first step in bringing about this unification, Mr. McCormick stated that he would suggest that the new Roseland pumping station be equipped with synchronous motors. He

prophesied that this step would be taken, and that by further following out his suggestions the city would be able to save $1,000,000 a year, and by complete unification might be able to save as high as $5,000,000.

At the conclusion of the lecture Prof. P. B. Woodworth and the members of the Institute Branch extended to Mr. McCormick a hearty vote of thanks.

### Wear and Life of the Essential Parts of Electric Street Cars.

A report of Director Stahl, of the Duesseldorf street railways, at the fifteenth international street railway congress in Munich, dealt with the chief parts of the cars in a mechanical respect, their life and the influence of their proper construction on the cost of maintenance. The majority of axle breaks are traceable to a weak construction of the axle in the region of the keyway of the large wheel. The radius of the axle should be increased by the depth of the keyway, so that a decrease in the average cross-section of the axle is avoided. The fastening of the tires by shrinking on, without the use of screws, has been generally found to be sufficient. The life of tires on standard-gauge roads is about fifteen per cent greater than on narrow-gauge roads. Sliding bearings for the axles have so far proved the most reliable; ball bearings are unsuitable, and as regards roller bearings, opinions are still divided. Springs for the trucks consisting of long leaves, with short spiral springs at the ends, have proved quite satisfactory. The spiral springs formerly placed between truck and body are not much used now, as they were subject to frequent breakage. The latest in the operation of sand sprinklers is the coupling of the controller handle with the sprinkler in such a way that when the handle is placed in the position of the emergency brake, sand is sprinkled automatically by means of a mechanical or electrical arrangement. On cars provided with air brakes, sprinklers are also employed in which the sand is blown into the sprinkling tube by the compressed air, when the controller handle is in the emergency-brake position. A large number of teeth of great width is essential for the noiseless working of the gearing.—*Translated and abstracted from Elektrotechnische Zeitschrift (Berlin), April 7.*

### Systems of Railway Electrification.

Under the above caption, N. W. Storer contributes the following item as an editorial in the June issue of the *Electric Journal.*

It is little to be wondered at that there is a confusion of ideas regarding the various systems in use for electric traction, when one considers them in all their details. A careful examination of three-phase, single-phase and direct-current installations in this country and in Europe has convinced the writer of the utter futility of comparing the systems on the basis of present installations. In every case the installation has some peculiar condition to meet which renders it unfit for comparison as to system, even in the most general terms.

For instance, in comparing three-phase and single-phase line construction, it is utterly ridiculous to compare the cost of the New Haven construction with its very substantial bridges and double-catenary suspension with that of the Simplon tunnel. If the simple construction of the latter, which is so light as to appear flimsy in the eyes of an American engineer, is safe for three-phase, it should be equally safe for single-phase. It is impossible to deny the fact that single-phase line construction is inherently much simpler, lighter and cheaper than that of three-phase. The light construction with direct suspension of the trolley wire, such as installed at the Simplon Tunnel, is apparently satisfactory for the slow and moderate speeds in use on all three-phase installations. If higher speeds were contemplated, catenary construction would be advisable if not absolutely necessary.

Again, in comparing the current collectors in use in this country with those in Europe, it must be remembered that the usual height of trolley wires in Europe is from fifteen to eighteen or nineteen feet with small variations, while for all steam railways in this country it is twenty-two feet with large variations. The maximum speed on any electric system in Europe rarely exceeds forty-five miles per hour, while seventy-five miles per hour is not infrequent in this country. The higher trolley wire and higher speed render the collection of current enormously more difficult and should be sufficient to explain the differene between American and European practice.

It has been customary to give the three-phase system the credit for all the advantages in light weight, due to the peculiar construction employing the Scotch yoke for connecting the motors to the driving wheels, and for the very light design of mehanical parts. The fact is that these features are not inherent with three-phase locomotives, but may be used to the same advantage with single-phase or direct-current locomotives. They have not been adopted in this country, because they have certain disadvantages which, in the eyes of American engineers, offset the advantages.

It has also been customary to credit the three-phase system with all the advantages of the simple control system in use on most of the three-phase locomotives. This is also a mistake, since if this control will meet the conditions of service satisfactorily with three-phase, the same type of control will give better operation with single-phase and will be cheaper, simpler and more efficient than when used with three-phase.

Further, in comparing the service capacities of different types of locomotives, it should be remembered that it is the tractive effort rather than the horsepower rating that determines the pulling power of a locomotive. For instance, it is customary to speak of the enormous horsepower rating of three-phase locomotives, and both direct-current and single-phase locomotives appear at a disadvantage with such a comparison. It must be remembered, however, that the rating of the three-phase locomotive is given at its maximum speed while the ratings of the single-phase and direct-current locomotives are usually given at less than half their maximum speeds. In service where the starting tractive efforts are much greater than those required for continuous operation, the horsepower ratings of three-phase locomotives will be much greater than those for direct current or single-phase. For example, the 071 locomotive built for the New Haven road has a tractive effort for one hour of about 18,000 pounds. Its normal speed on level track is about forty-five miles per hour, and it frequently reaches fifty miles per hour. A three-phase locomotive having these characteristics would be called a 2,400-horsepower locomotive, and yet it would have practically no greater service capacity than the 071 which is rated at 1,600 horsepower. In other words, the great difference in the

speed characteristics of the different motors renders a comparison on the basis of the horsepower ratings utterly misleading—except where the locomotives are required to operate continuously at a certain tractive effort and speed. Under these conditions a comparison on the basis of continuous horsepower rating will be correct.

In Europe the war of the systems goes merrily on. Italy seems to be pretty solid for three-phase, all the other countries except Switzerland, which is divided, are considering only single-phase. There are a few sporadic cases of high-voltage direct-current, but they are not considered as serious.

The conclusions arrived at by the writer are: (1) That systems can be compared only by eliminating all differences that are not inherent. (2) That three-phase will give very satisfactory results where the speeds are uniform and low or moderate, and especially for work on heavy grades where the advantage of light weight is greatest, and the automatic regeneration of power serves to hold the train back in descending grades. (3) That the single-phase system is able to meet practically any conditions of operation in general railway service, and that it is superior where a variety of speeds and especially high speeds are required and where the simpler overhead construction is especially desirable. (4) That neither of the alternating-current systems would be necessary or desirable, if direct current at 600 volts could be collected from a distributing system, including substations and contact conductors, as simple and cheap as that of the single-phase system.

### Examination for Reclamation-Service Engineers.

The United States Civil Service Commission announces that on July 13 and 14 an examination will be held to secure eligibles for vacancies which may occur in the Reclamation Service in the position of assistant engineer and junior engineer.

Applicants should apply for application Form 1312 and a copy of the Manual of Examination revised to January 1. These may be obtained from the Commission at Washington, D. C., or from the secretaries of the various boards of examiners.

These positions offer the finest kind of experience for young engineers who having a liking for government service.

### Central Electric Railway Association.

The regular bi-monthly meeting of the Central Electric Railway Association was held in Toledo, Ohio, May 26 and 27. About 130 members including supply men being in attendance. Special interurban cars, carrying members and invited guests, were run from South Bend, Terre Haute and several points in Ohio.

The meeting, which was held in the assembly room of the Boody Hotel, was called to order by the president, George Whysall, who introduced Mayor Whitlock. Mr. Whitlock made the opening address, welcoming the traction men to the city. Reports of special and standing committees took up the time of the opening session. "Prevention of Accidents" was the subject of a paper read at the March meeting by E. F. Schneider, general manager, Cleveland Southwestern & Columbus Railway, and was the first paper discussed. An abstract of Mr. Schneider's paper appeared in the May 21 issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.

The discussion of this subject was rather interesting since it was evident that there was some difference of opinion as to the best means of preventing accidents. Incidents and personal experiences were cited by those participating in the discussion.

A number of papers of interest to the members were read during succeeding sessions and among these was one on "The Valuation of Operating Properties," by Edgar S. Nethercutt of Chicago, who declared that the relation between the public and the public-service corporation was undergoing a change. He said that the new grants that might be made under an indeterminate franchise would involve the valuation of the property to determine the investment. "Settlements of this form," he added, "practically amount to a determination of the rate. Reductions of the rate below a certain point will result either in a reduction in the service or the return of investment, unless the municipality assumes part of the construction costs. What is then saved in fare is made up in taxation. The man who has no property, but patronizes the public service corporations, does so chiefly at the expense of the man who has taxable property." Mr. Nethercutt's paper brought out a hearty discussion of the subject and a number of interrogatories were answered.

"Track Bonding" was the subject of a descriptive paper presented by T. W. Shelton, master mechanic of the Indianapolis, Columbus and Southern Traction Company. The closing session was devoted to the consideration of recent legislation. S.

### Edison Banquet at Long Beach, Cal.

The members of the Southern California Edison Company were, on May 25, given a banquet at the Hotel Virginia, Long Beach, by the Chamber of Commerce of that city. The banquet was given as a celebration of the success of the Chamber of Commerce in securing for Long Beach the $10,000,000 which the Edison Company is soon to build.

A rather interesting feature of the banquet was the arrangement of the electrical decorations.

The dining room was most elaborately decorated, 25,000 small colored electric lights being used and four electrical fountains adorned the room. At the entrance to the banquet hall, the guests were confronted with a revolving electric wheel which at ten-minute intervals stopped, all the lights going out but those which spelled in large letters the word "Edison."

### Chicago Elevated Roads to Merge.

Three of the four elevated railroads of Chicago have agreed to sell their properties to Henry A. Blair of the Chicago Railways Company. The fourth company has the matter under advisement. Should this company decide to enter into a merger, it will probably be effected in a short time.

Mr. Blair, it was recently announced, has been given options on the South Side Elevated, the Northwestern Elevated, and the Chicago and Oak Park. As the Union Loop is owned by the Northwestern Elevated Company, it goes with that property. No option has as yet been given by the Metropolitan Elevated.

The transaction is backed by the National City Bank of New York, and it is the intention to offer cash to those stockholders who desire cash and to exchange securities with those who still wish to retain an interest in the company. The present $45,524,700 capital stock will be the outside figure in the way of new securities, and if the transaction is made it will be done without big promotion profits and the stock will not be watered.

## AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

MEETING AT ATLANTIC CITY, MAY 31 TO JUNE 3.

The regular spring meeting of the American Society of Mechanical Engineers was held at Atlantic City, May 31 to June 3. Headquarters were at the Marlborough-Blenheim Hotel, and about 150 members registered. The meeting, while small in point of numbers, was very successful from the standpoint of interest, the various papers being well discussed. The first professional session presided over by George Westinghouse, was held on Wednesday morning, and comprised four papers of general interest to the machinist. They were entitled respectively, "The Shockless Jarring Machine," by Wilfred Lewis; "A Comparison of Lathe Headstock Characteristics," by Prof. Walter Rautenstrauch; "The Strength of Punch and Riveter Frames Made of Cast Iron," by Prof. A. L. Jenkins, and "Improved Methods in Finishing Staybolts and Straight and Taper Bolts as Used in Locomotives," by C. K. Lassiter.

MOLDING MACHINE.

Mr. Lewis's paper dealt with a new type of molding machine, in which the shock transmitted to the ground in the earlier types of machines is absorbed as effective work by the machine itself. This machine saves substantially all of the ramming time, and in combination with others, saves pattern drawing and finishing time and opens the way to economies of startling magnitude in the foundry.

The discussion included a commendation by Mr. Outerbridge of the work done by Mr. Lewis, in presenting this machine, which marks a great advance in foundry practice.

LATHE CHARACTERISTICS.

Professor Rautenstrauch's paper is concerned with the determination of the adaptability of a number of engine lathes to the economic performance of a standard task. The method of comparison consists in determining the extent to which each speed-torque combination possible in a given lathe lends itself to removing the greatest weight of shavings in a given time from a given diameter of work. The standard task assigned to each lathe is taking a predetermined area of cut on all diameters of work of mild and soft steel pieces, with high-heat steels. The results of the comparison show, among other things, that a more rational means of spacing speed-torque combinations is needed. Many of the lathes examined are shown to have a number of speed-torque combinations which may be dispensed with as far as their adaptability to more economic weight removal is concerned, no matter what the standard of comparison may be.

In the ensuing discussion it was pointed out that heretofore the mechanical engineer had been considered largely a power plant man; that he had been instructed in engine and boiler design and performance, but that comparatively little attention had been given to the other phases of engineering. This paper is an evidence of the wide field that is filled by the mechanical engineer, and of the great value he is to industrial work as a whole.

PUNCH AND RIVETER FRAMES.

In the paper on the strength of punch and motor frames by A. L. Jenkins, a brief résumé is given of the important theories proposed for the analysis of stresses in straight cast-iron beams. The examination of the various formulas proposed for curved beams shows that certain assumptions made in their derivations are not true for cast-iron. A criticism of the Résal and Pearson-Andrews formulæ states that they are not true for cast-iron, are unwieldy in their application and involve considerable chance of error. The writer claims that calculations based on a load-deflection curve drawn by the autographic recorder on a testing machine are of no value.

Following this, Mr. Lassiter's paper on stay bolts was read.

STAY BOLTS.

This paper shows the method of finishing stay-bolts (in particular the water-space stays), the advantages of reducing in the center and how this may be done automatically during the threading operations, the automatic drilling of tell-tale holes in these staybolts, and the advantages over other methods, such as drilling when in place. With the reading of this paper, the proceedings of the day were concluded. The afternoon and evening were reserved for social events.

The second professional session, held on Thursday morning, was in charge of the Gas Power Section, and Mr. Bibbins was in the chair. Four good papers were presented, which were extensively discussed. The first of these was entitled "A Regenerator Cycle for Gas Engines using Sub-Adiabatic Expansion," by Prof. A. J. Firth.

GAS ENGINE.

A new cycle, of theoretically 100 per cent efficiency, caused by the expansion line being steeper than that caused by free expansion. The author also endeavors to show that in the older regenerative cycles the loss of heat to water cooling overbalances the theoretical economy, which is avoided in the engine using the cycle here described. How the brake efficiency, under practical conditions, may be derived from formula and a heat expenditure of 7000 B. T. U. may be expected with a compression pressure of only 125 pounds by the gauge, and a peak pressure of 275 pounds gauge, are also described. This means fifty per cent greater economy in fuel than is usual, say, with illuminating gas. A chart showing the variations of regenerator efficiency with size, indicates that only practical conditions and temperatures are required to carry out the cycle. A design is shown in which no scavenging is required, no mixtures are made and spontaneous ignition appears. It comprises two equal cylinders of unequal stroke, with a regenerator between them, gas being compressed in the small and air in the large cylinder. The air passed through the regenerator at a high temperature and mixed with the gas at the point of highest compression of the entire charge, at which point it is ignited. While the danger of pre-ignition is avoided, the conditions for perfect combustion are coupled with light pressure and ordinary good workmanship.

In the discussion which followed, S. A. Moss took sharp issue with the author. He claimed that an efficiency of 100 per cent was impossible with the cycle as described. He pointed out that a fundamental error had been made in developing the cycle, and that an important basic principle of heat transferance had been neglected. In effect he said, Professor Firth proposed to transfer heat from a lower to a higher temperature, which is an impossibility. In using this cycle, Mr. Moss stated that it would be necessary to expand the gas along a sub-adiabatic curve for a certain distance, and then to complete the expansion on an adiabatic. In this way some heat would necessarily be lost, and the efficiency materially reduced below 100 per cent.

Professor Magruder was of the opinion that it would be impossible to obtain, with a commercial engine, indicator card curves anything like those shown in the paper. He cited a series of experiments in which he had demonstrated that the heat in the cylinders of a gas engine was not all generated at the instant of explosion, but during the entire stroke. The combustion was gradual instead of instantaneous. As Professor Firth had based his theoretical indicator card curves on the assumption of instantaneous combustion, he would find that his practical engine would have a cycle considerably different from that which he expected. Professor Magruder also spoke of some experiments in which temperatures in gas-engine cylinders were measured, and found to be over 2400 degrees Fahrenheit at the end of the stroke. With a terminal temperature as high as this, it was a safe assumption that the expansion curve, instead of being a sub-adiabatic as assumed by the paper, was higher than an adiabatic.

C. W. Baker believed that the regenerator would give considerable trouble before it could be reduced to practical form. In reply to the various criticisms, Professor Firth stated that there was no transfer of heat from a lower

to a higher temperature. Owing to the peculiar construction of the engine, the transfer of heat was always from a high to a low temperature, although from the form of the curves given the reverse appeared to be true.

H. G. Reist next read a paper entitled "Gas Engines for Driving Alternating Current Generators."

This paper points out briefly the problems which must be solved to obtain best parallel operation of alternating-current generators when driven by means of gas engines. While some assistance can be given in designing the generator, the most satisfactory solution of the problem is so to design the gas engine that as nearly even rotation as possible is obtained. Uniformity of rotation of gas engines is dependent on (*a*) the number of impulses per revolution, which in turn is dependent on the number of cylinders and arrangement of cranks and on whether a two or a four-cycle system is used; (*b*) the compression and weight of the reciprocating parts; (*c*) the time of ignition; (*d*) the weight of the flywheel. The use of a heavy flywheel, however, is the least desirable method of obtaining even rotation of the engine shaft, and other means should be used to obtain as uniform rotation as possible. The following seem to be the desirable characteristics of gas engines for driving alternators: (*a*) High speed. This will require fewer poles with a given frequency and a greater angular variation will be allowable. (*b*) A light flywheel. This will allow the current to keep the generators together with a minimum disturbance. (*c*) Large engines should be built with many cylinders and cranks so placed as to contribute to an even turning moment.

This paper caused no discussion, but the following one by Professor Magruder on "Two Proposed Units of Power" excited considerable.

UNITS OF POWER.

The paper gives a brief review of the development of the various units of power as applied to steam boilers, and shows how they have been changing in definition and value, with a comparison of the values in B. T. U. of the units of evaporation and of boiler horsepowers. An objection is made to the use of the term horsepower as applied to steam boilers, since as the output of a steam boiler is heat energy, it should be so measured. The capacity or power of a boiler and its output of energy should therefore be measured in "boiler-powers." A boiler power is defined as 33,000 B. T. U. of heat energy delivered per hour by a steam boiler, steam main or hot-water heating main, or the like, or added per hour to the feed-water of a boiler or to the water of a hot-water heating system. Similarly, an objection is raised to the term "horsepower" as the unit of measurement of the output of heat energy of a blast furnace, coke oven, gas producer, gas main or an oil well. The statement is made that 10,000 B. T. U. of heat energy are required per hour as the average of the best gas engine practice today for the development of a mechanical horsepower. It is proposed that the heat energies of gaseous and liquid fuels be measured in "gas-power," a gas-power being defined as 100,000 B. T. U. of heat energy delivered per hour by a gaseous or liquid fuel.

Wm. Kent objected to the addition of any new units to the nomenclature now in use. He reviewed the work of the committees of the Society which had passed on these questions, and showed that Professor Magruder's suggestions had all been considered at one time or another and rejected for some good reasons.

H. G. Stott approved of the propositions to adopt a new unit, but suggested that its value be such that it would have a direct relation to the number of heat units equivalent to a kilowatt. He proposed the name "Thurston" for this unit, following the practice in electrical engineering of naming the units after great investigators.

BLAST-FURNACE POWER PLANT.

The paper attracting the most attention was that by H. J. Freyn, dealing with operating experiences with a blast-furnace gas-power plant.

The plant under discussion consists of four 2,000-kilowatt gas engine generators receiving blast furnace gas cleaned in a preliminary and secondary washing plant. The former consists of two tangential dry dust catchers and two wet scrubbers, or hurdle washers, while in the latter Theisen gas washers are used. The gas is supplied by six blast furnaces, and had in 1909 an average heat value of 98.3 B. T. U. per cubic foot and contained 26.51 per cent CO, 3.57 per cent H, and 0.196 per cent $CH_4$. The temperature of the gas entering the gas cleaning plant averages 33.4 degrees Fahrenheit, which was reduced during the cleaning process practically to atmospheric temperature at the engines. The average raw gas pressure was 9.29 inches of water, while gas of 4-inch pressure is delivered by a 100,000-cubic foot gas holder. The average amount of flue dust in the dry cleaned gas was 1.53 grains per cubic foot, which during the washing process was reduced to 0.0058 grains per cubic foot. The wet scrubbers took out 80 per cent and the secondary cleaning plant 98 per cent of the amount of dust received. The total efficiency of the gas washing plant was 99.5 per cent. The amount of moisture in the engine gas averaged 5.62 grains, against 3.49 grains in the atmospheric air. The amount of water used for gas cleaning averaged 102 gallons per 1,000 cubic feet of gas cleaned, 83 gallons of which were used in the wet scrubbers and 19 gallons in the Theisen washers. The power consumed in the gas cleaning plant was 3.3 per cent of the gas engine output. The load factor for the year was 72 per cent and the average running time was 77 per cent of the total possible time. The thermal efficiency at the shaft of the plant, as determined continuously by Venturi meter, averaged 20.8 per cent for 1909.

The discussion turned largely on the question of gas cleaning. Jos. D. Morgan described the difficulties encountered at the Cambria steel plant in an early installation of dust catchers, wherein the gas was led radially to the dust catcher, instead of tangentially. Although the dust catcher was thirty feet in diameter, the incoming gas stirred up the dust deposited at the bottom of the dust catcher, and it was carried out with the supposedly clean gas. Later the downcomer was connected tangentially, with a resulting improvement in efficiency of about eighty per cent.

E. A. Uehling described a simple dust catcher in which the principle of low velocity of the gas through the dust catcher was depended upon to give the dust time to fall out of the gas and settle in the lower part of the chamber. Properly arranged baffles prevented the dust from being caught up again by the gas. Another speaker described the remarkably efficient three-stage gas cleaning plant at Steelton, Pa., which comprises a centrifugal type dry dust catcher, two tower scrubbers and a pair of rotary washers, all in series. Mr. Uehling further commented on the paper by saying that it had been computed that the average blast furnace gave off sufficient gas to develop 800 horsepower per ton of iron per hour, over and above all the requirements of the plant. This figure is twenty-five per cent better than has ever been done, and the secret of the problem of attaining this high efficiency is a better method of cleaning gas. Clean gas is just as essential for the stoves and boilers as it is for gas engine.

H. G. Stott called attention to the fact that the thermal efficiency obtained by the gas plant described by Mr. Freyn is almost identical with that given by the combined reciprocating engine and low-pressure steam turbine plant.

The Thursday afternoon session was called to order by Mr. Westinghouse, who later resigned the chair to C. W. Baker. The proceedings opened with a paper "The Mechanical Engineer and the Textile Industry" by H. L. Gantt.

TEXTILE ENGINEERING.

The subject of industrial engineering has of recent years begun to attract the attention of the mechanical engineer, and the object of this paper is to call his attention to a portion of this field—the processes of a bleaching plant—that so far has had but little attention from him, and in which there are great possibilities. In the past, the most important work of the mechanical engineer has been in the line of steam engineering, and the progress he is still making in that line, in spite of the high efficiency to which the prime movers have been brought, is a testimony to his success.

There was no discussion offered on this paper, and the society then listened to J. H. Capp's paper on "The elastic limit of Manganese and other bronzes."

ELASTIC LIMIT OF BRONZES.

At a stress but little above the elastic limit, or limit of proportionality of stress to strain, mild and medium steels show a characteristically sudden breakdown, such that during an appreciable interval the specimen stretches without increase of load. This

point, called the "yield point," is marked by a jog in the autographic elastic curve, and is indicated by the dropping of the beam of the testing machine and by the slipping of the points of dividers held in bench marks on the specimen. The paper deals with the elastic curves of brasses and bronzes, which show no such break or jog, but, characteristically, are smooth curves, substantially straight at first and gradually bending over at an increasing rate as stress increases. Hence the locating of a so-called yield point, in testing bronzes or brasses by commercial methods, is entirely a matter of the judgment of the operator, and the point reported bears no definite relation to the elastic limit or limit of proportionality as indicated by the elastic curve.

Following this paper an abstract of a paper on "The Relation of Freight Train Resistance to the Average Car Weight," by Prof. Edward C. Schmidt was read.

TRAIN RESISTANCE.

The paper deals with the results of tests made upon the Illinois Central Railroad by the Railway Engineering Department of the University of Illinois to determine the resistance of freight trains. The relation between train resistance, as defined in pounds per ton, and speed in miles per hour, is expressed for trains of various weights per car, the marked influence of car weight being indicated by the following facts: At a speed of five miles per hour the resistance of a train in which the cars average 75 tons in gross weight is 3 pounds per ton, whereas for a train whose average car weight is 15 tons the resistance is 7½ pounds per ton, a difference of 150 per cent. At higher speeds the relation between resistance values is about the same as at low speeds. At forty miles per hour, for example, the resistance of a train of 75 tons average weight per car is 5½ pounds per ton, while for a train of 15 tons average weight per car it is 13½ pounds per ton. The trains tested vary in weight up to 3,000 tons. The tests were made over main-line track of good construction, laid with eighty-five-pound rail, during weather when the temperature was above thirty degrees and when the wind velocity did not exceed twenty miles per hour. The test data are displayed in the paper.

In the discussion which followed it was pointed out that the great irregularities shown in results might have been due to the inefficiency of the lubricating system of car journals, to the effect of vibration of the cars and to the influence of the condition of the track, a good track giving a low car journal friction. Mr. Stott questioned whether a general law could be deduced from the experiments on account of the dissimilarity of conditions under which the various experiments were made.

The remaining paper of this session was entitled

"THE HYDROSTATIC CHORD."

This name is given to a novel shape for large pressure conduits. It is particularly applicable only to very large pipes working under comparatively low pressure head and lying in a shallow trench. Its function is to produce a tendency in the pipe to round out after the pressure reaches a certain mean value, which causes an effort to increase the vertical diameter, thus tending to lift both the dead weight of the pipe shell itself and the top fill. In a circular shape no such tendency exists, and all the deforming forces add together to produce severe bending moments, which are aggravated by the direct tension due to the water pressure. With a shape properly designed on correct hydrostatic principles the bending moments may be made to offset each other in such a way that nearly pure tension may be brought about at some assumed maximum operating pressure.

At the usual reception on Thursday evening, variety was added to the proceedings by conferring honorary membership on Rear Admiral Geo. W. Melville, U. S. N., retired. President Westinghouse made a brief address in conferring this to which Admiral Melville replied, stating that he considered this the highest honor he had received, because it was given by men who had done things, and appreciated achievement at its true worth. A more formal address, dealing with the work of the engineer was then read for Admiral Melville by Walter B. McFarland. Sir William White, of England, who was in attendance at the meeting, spoke briefly on the services of Admiral Melville as an engineer.

At the session on Friday morning, the first paper read was by Henry Hess, and dealt with

BALL BEARING LINE-SHAFT HANGERS.

The paper gives in detail the actual and relative first cost of a line-shaft installation, consisting of hangers, boxes, shaft, pulleys and belt, transmitting forty horsepower at 200 revolutions per minute, on plain bearings, then on ball bearings at 600 revolutions per minute. The latter costs less by $117.08, a saving of twenty-one per cent in first cost; this carries with it an annually recurrent saving of $36.90 in power.

The question of the attachment of hangers in concrete buildings was raised in the discussion, which led to the subject of dust in these buildings and their effect on the bearings. Mr. Hess, in reply, pointed out that dust could only injure a bearing if it got inside of it, but that if properly lubricated no dust could enter. A ball bearing was easier to keep in this condition than any other. The question of alignment was also raised, and also the effect of misalignment on ball bearings. It was shown that a load of four times the rated capacity would barely cause the ball bearing to overheat, while a plain bearing would give evidence of distress long before that point was reached. A case was cited, where the friction load of a line shaft was forty-two per cent, due to tight belts, mule pulleys, etc. It was stated that this load, with ball bearings would be reduced by sixty per cent. The ordinary friction load of a line shaft is about eighteen per cent.

A paper entitled "Experimental Analysis of a Friction Clutch Coupling," by Prof. W. T. Magruder, was read next.

FRICTION CLUTCH COUPLING.

This paper gives the results of five lines of investigation: *a*, on a dynamic clutch-testing machine; *b*, on a static apparatus, using twenty-four-inch four-jaw friction clutch couplings from stock. The solid clutch broke at 200 horsepower at 100 revolutions per minute, when load was gradually applied, and at 110 horsepower at 100 revolutions per minute for a pick-up load; the split clutch broke at 140 horsepower at 100 revolutions per minute with load gradually applied. A maximum axial thrust on the collar of 600 pounds may be required, or 115 pounds at the end of a one-to-five shifter lever, creating a total pressure of 8,000 pounds by the shoes on the ring, or 50 pounds per square inch. The factor of safety of ten, adopted by manufacturers, is ample.

In discussing this paper Mr. Schmidt stated that a factor of safety of ten was too high. He gave an illustrated talk on the history of friction clutches and showed their development. He stated that most breakages occurred in the hub, due to weakness on account of insufficient room for good mechanical construction. In relation to clutches for use in connection with gas engines driving shops the following rule was given: With single-acting, single-cylinder gas engines use a clutch of double the rated capacity of the engine; with double-acting single-cylinder engines use a clutch of capacity twenty-five per cent greater than the rated capacity of the engine; with multi-cylinder engines use a clutch of the same rated capacity as the engine.

Oberlin Smith stated that most friction clutches were made of too small diameter, and that they should be run at a circumferential speed of about a mile a minute. Fly-wheel clutches should run at about 500 revolutions per minute.

"An Improved Absorption Dynamometer" was the title of a paper by Prof. C. M. Garland.

ABSORPTION DYNAMOMETER.

This paper describes a type of eddy-current dynamometer adapted for the absorption of power given out by motors under test, with an enumeration of the conditions that an absorption dynamometer should fulfil, illustrating the advantage of this machine. The dynamometer consists of a copper disc revolving between the poles of an electromagnet. The power absorbed is utilized in the generation of eddy currents in the disc, which short-circuit among themselves and produce heat, which is carried off by circulating water. The change in load is effected by a rheostat in series with the exciting coil. Attention is drawn to the flexibility of the design and the adaptability of the machine to both large and small powers.

The final paper of the meeting was one on "Critical Speed Calculation," by S. H. Weaver.

## ILLUMINATING ENGINEERING COURSE AT JOHNS HOPKINS UNIVERSITY.

WITH THE CO-OPERATION OF THE ILLUMINATING ENGINEERING SOCIETY.

A circular has just been issued by the Johns Hopkins University, Baltimore, announcing that a course of thirty-six lectures on illuminating engineering, extending from October 26 to November 8, 1910, will be given at that university. This course of lectures has been arranged upon the initiative of the council of the Illuminating Engineering Society, which by resolution decided to organize such a course and appointed a committee to take the necessary steps to that end.

The lectures will follow immediately the annual convention of the society, which, upon the invitation of the president of the Johns Hopkins University, will be held at that institution beginning Monday, October 24, 1910.

This course owes its origin to the following considerations: The Illuminating Engineering Society, recognizing the fact that there is an increasing demand for trained illuminating engineers and that the present facilities available for the specialized instruction required are inadequate, determined to encourage the establishment of a course of lectures on the subject of illuminating engineering. This course should have three objects: (1) to indicate the proper co-ordination of those arts and sciences which constitute illuminating engineering; (2) to furnish a condensed outline of study suitable for elaboration into an undergraduate course for introduction into the curricula of undergraduate technical schools; and (3) to give practicing engineers an opportunity to obtain a conception of the science of illuminating engineering as a whole.

Inasmuch as such a course is most appropriately given at a university where graduate instruction is emphasized, and as the Johns Hopkins University has regularly offered courses by non-resident lecturers as part of its system of instruction and is now preparing to extend its graduate work into applied science and engineering, an arrangement has been effected by which the lectures will be given at this university under the joint auspices of the university and the Illuminating Engineering Society. The subjects and scope of the lectures have been proposed by the society and approved by the university. The lecturers have been invited by the university upon the advice of the society.

The university will provide facilities for demonstrations at lectures and will also have installed a working exhibit of apparatus for experimental work in light, illumination and illuminating engineering. The apparatus will be at the disposal of those who attend and an opportunity will be afforded to undertake laboratory work during the term of the lecture course under the supervision of trained experts of the university and of the society.

The programme of lectures, together with the list of lecturers, is as follows:

I. "The Physical Basis of the Production of Light." Three lectures. Dr. Joseph S. Ames, professor of physics, Johns Hopkins University.

II. "The Physical Characteristics of Luminous Sources." Two lectures. Dr. Edward P. Hyde, president, Illuminating Engineering Society; director of physical laboratory, National Electric Lamp Association.

III. "The Chemistry of Luminous Sources.' One lecture.' Dr. Willis R. Whitney, director of research laboratory, General Electric Company.

IV. "Electric Illuminants." Two lectures. Dr. Charles P. Steinmetz, consulting engineer, General Electric Company; professor of electrical engineering, Union University.

V. "Gas and Oil Illuminants." Two lectures. (1) M. C. Whitaker, professor of industrial chemistry, Columbia University. (2) Dr. Alexander C. Humphreys, president of Stevens Institute of Technology.

VI. "The Generation and Distribution of Electricity with Special Reference to Lighting." Two lectures. Dr. John B. Whitehead, professor of applied electricity, Johns Hopkins University.

VII. "The Manufacture and Distribution of Gas, with Special Reference to Lighting." Two lectures. (1) A. G. Glasgow, London, England. (2) Walter R. Addicks, vice-president of Consolidated Gas Company, New York.

VIII. "Photometric Units and Standards." One lecture. Dr. Edward B. Rosa, physicist, National Bureau of Standards.

IX. "The Measurement of Light." Two lectures. Dr. Clayton H. Sharp, test officer, Electrical Testing Laboratories, New York city.

X. "The Architectural Aspects of Illuminating Engineering." Two lectures. Walter Cook, vice-president, American Institute of Architects.

XI. "The Decorative Aspects of Illuminating Engineering." One lecture. Louis C. Tiffany, president of the Tiffany Studios, New York.

XII. "The Physiological Aspects of Illuminating Engineering." Two lectures. Dr. P. W. Cobb, physiologist of the physical laboratory of the National Electric Lamp Association.

XIII. "The Psychological Aspects of Illuminating Engineering." One lecture. Dr. John B. Watson, professor of experimental psychology, Johns Hopkins University.

XIV. "The Principles and Design of Interior Illumination." Six lectures. (1) L. B. Marks, consulting engineer, New York city. (2) Norman Macbeth, illuminating engineer, the Welsbach Company.

XV. "The Principles and Design of Exterior Illumination." Three lectures. (1) Dr. Louis Bell, consulting engineer, Boston. (2) E. N. Wrightington, Boston Consolidated Gas Company.

XVI. "Shades, Reflectors, and Diffusing Media." One lecture. Van Rennselaer Lansingh, general manager of the Holophane Company.

XVII. "Lighting Fixtures." One lecture. Edward F. Caldwell, senior member of firm and designer, Edward F. Caldwell Company, New York.

XVIII. "The Commercial Aspects of Electric Lighting." One lecture. John W. Lieb, Jr., third vice-president, New York Edison Company.

XIX. "The Commercial Aspects of Gas Lighting." One lecture. Walton Clark, president of the Franklin Institute, of Philadelphia; third vice-president, United Gas Improvement Company, Philadelphia.

The laboratory demonstrations will be under the direction of:

Charles O. Bond, manager of photometric laboratory, United Gas Improvement Company, Philadelphia.

Dr. Herbert E. Ives, physicist, physical laboratory, National Electric Lamp Association.

Preston S. Millar, Electrical Testing Laboratories, New York; general secretary, Illuminating Engineering Society.

The course of lectures should merit the support of those interested in illuminating engineering, to all of whom the course is open on equal terms. The scope of the lectures, together with the list of lecturers, should insure a large and representative audience. A fee of $25 will be charged for admission to the course and to the accompanying laboratory instruction. Cards of admission to the course, and information regarding the facilities for individual laboratory work, can be secured upon application to the Registrar of Johns Hopkins University or the General Secretary of the Illuminating Engineering Society.

### Chicago Telephone Company.

The Chicago Telephone Company has issued a report to the city of Chicago, covering its services within city limits, for the year ended April 1, 1910, as follows:

Gross revenue, $7,864,771; operating expenses, $6,973,796; net revenue $890,975; interest charges, $186,672; dividends, $1,612,846, and deficit, $908,536.

There were 203,063 telephones in service, and 244,375,672 messages transmitted during the period.

### Old Time Telegraphers' Reunion.

The twenty-ninth annual reunion of the Old Time Telegraphers and Historical Association and the Society of the United States Military Telegraph Corps, will be held in Chicago, September 8, 9 and 10, at the Auditorium Hotel.

**Commission News From New York.**

The New York Public Service Commission, Second District, has authorized the Economic Power and Construction Company to transfer and sell to the Geneva-Seneca Electric Company all its franchises, systems, works and property of the Economic Company in the city of Geneva. The consent is given on the express condition that the Geneva-Seneca Electric Company shall at any time within thirty days ,if requested by the City of Geneva, enter into a contract with the city for the rental of two ducts or conduits for the carrying of electric wires in each of the Exchange Street, Seneca Street and Linden Street subways, for a term expiring March 31, 1928, at an annual rental of five cents per lineal duct foot. In this connection, the application of the Economic Power and Construction Company for authority to exercise franchises granted by the city of Geneva, is denied.

The Geneva-Seneca Electric Company is authorized by the Commission to issue bonds secured by an existing mortgage to an amount not exceeding $114,444, to be sold at not less than ninety, and to use $103,000 of the proceeds for the sole purpose of paying for the property of the Economic Power and Construction Company in Geneva.

The Commission has authorized the Orange County Traction Company, Newburgh, N. Y., to issue a first and refunding mortgage upon all its property, estates and franchises of the company to The Union Trust Company of Albany, New York, as trustee, to secure the payment of $750,000 in fifty-year, five per cent bonds; the company is also authorized to issue at once bonds to the amount of $233,800 to be sold at not less than eighty-five. The proceeds are to be used to discharge indebtedness of the corporation incurred in additions, improvements and equipment. The company is further authorized to issue bonds to the amount of $425,000 at not less than par, without further authorization of the Commission for the purpose of refunding existing bonded indebtedness, bonds to be exchanged at any time, par for par.

The Commission has authorized the East Hampton Electric Light Company of East Hampton, Suffolk County, to execute and deliver to the New York Trust Company a first mortgage upon its property, to secure an issuance of six per cent twenty-five year gold bonds in the aggregate amount of $60,000; the company is also authorized to issue at the present time $34,500 in bonds, the proceeds to be used in discharging obligations incurred in the improvement and betterment of the company's plant.

The Public Service Commission, Second District, has authorized the Mohawk Gas Company of Schenectady to exercise its franchise and begin construction in the town of Niskayuna. The extensions are for the benefit of the neighborhood outside of Schenectady, which is rapidly growing up. The company in its petition stated that it had been requested to extend its gas mains and conductors in the town of Niskayuna for the purposes of furnishing gas for light, heat and power to the inhabitants of that town.

The Commission, Second District, has authorized the Schenectady Railway Company to sell, transfer and assign to the United Traction Company all its right, title and interest in the franchises granted by the Common Council of the city of Albany in 1901, which franchise authorizes the Schenectady Railway Company to construct, maintain and operate an electric railroad for public use over and along Central Avenue in the city of Albany from a point at the intersection of Watervliet and Central avenues in the city of Albany to the western boundary line of the city where the same crosses Central Avenue. The Schenectady Railway Company is authorized to sell, transfer and assign to the United Traction Company all its right, title and interest to all fixtures, structures and sidetracks on the streets and highways above referred to.

The Public Service Commission, Second Division, has denied the application of the North Shore Electric Light and Power Company, which sought permission to do business in the towns of Brookhaven and Smithtown, Suffolk county. There is already existing in that locality the Port Jefferson Electric Light Company.

After a number of hearings the Commission found that the territorial area now served by that company and proposed to be served by the applicant company, does not now and will not in the immediate future afford a sufficient demand for electric current to make the operations of two companies therein successful or desirable.

**Telephone Companies Consolidate.**

Official announcement was made by Thaddeus S. Lane, president of the Home Telephone Company, of Spokane, on May 30, that by a traffic agreement between the company and the Interstate Telephone Company, also of Spokane, there was brought about the consolidation of more than $2,000,000 of invested capital in eastern Washington, the "panhandle" of Idaho and points in western Montana. This gives the Interstate company an exclusive connection with the Spokane exchange of the Home company for the interchange of long-distance business between Spokane and all points on the Interstate company's lines in the panhandle of Idaho, eastern Washington and all territory hereafter acquired. It also consolidates the two headquarters and brings them into the Home company's new exchange building.

"The Home Telephone Company, which has $1,000,000 invested here, will have 5,000 automatic instruments in operation in Spokane by the first of January, 1911, when the franchise, becomes effective," said Mr. Lane. "After that the instruments will be installed at the rate of 1,000 a month. There will be no party lines, no prefixes or suffixes to the numbers, and all the traffic will be done by the automatic phones. A straight rate of $2 per month will be charged for residence and $6 per month for business telephones. This will mean a direct trunk line for every telephone."

The Interstate Telephone Company at present has 2,500 instruments installed, covering territory within a radius of 150 miles of Spokane. The company has 1,200 miles of long-distance circuits, and construction work is being rushed. Mr. Lane also announced that the telephones used by the Interstate Telephone Company will be replaced immediately by automatic instruments of the latest type.

The Home company will have direct connections with all the long-distance lines operated by the Interstate company to the following cities: Wallace, Wardner, Kellogg, Mullan, Murray, Harrison, Burke, Coeur d'Alene, St. Maries, St. Joe, Sandpoint, Spirit Lake and Rathdrum, Idaho, and Davenport, Reardan, Ione and Metaline, Wash., as well as points in Montana and along the proposed extension of the Chicago, Milwaukee & Puget Sound.

## SANITARY DISTRICT POWER.

ADDRESS BEFORE CHICAGO ELECTRIC CLUB.

The development of the Sanitary District, its scope and its future, were topics chosen by Robert R. McCormick, president of the Board of Trustees, Sanitary District of Chicago, in an interesting address delivered before the Chicago Electric Club at the regular meeting of that body on Wednesday, June 1.

Opening his talk with a comparison between governmental and private enterprises, Mr. McCormick gave examples of those belonging to the former class and those belonging to the latter. The work of the Sanitary District in constructing the drainage canal was a governmental enterprise but the subsequent sale of stone and dockage made possible by the canal was, according to the speaker, a private enterprise to reimburse the people for the vast expenditures in connection with the construction of the canal.

Also the construction of a water-power plant and the sale of current, authorized by the Supreme Court in 1903, was termed a private enterprise by Mr. McCormick, who said that after several unsuccessful attempts to contract for the entire electrical output, the Sanitary District decided to sell the current commercially itself.

The contract the District recently closed with the city for supplying current for street lighting was referred to and Mr. McCormick said that he looked for great future development along this line. Also, in the opinion of the speaker, all city waterworks should be electrically operated by power from the Sanitary District's plant and definite action is expected soon.

Speaking of the future, Mr. McCormick said that the time is not far off when electricity generated by the Sanitary District will be supplied to the County Building, City Hall and all municipal institutions. Furthermore, any power which may be in excess of civic needs will be sold to such individuals as wish to contract for it.

In closing, the speaker said that he looked forward to the time when the Sanitary District's lines and those of the local company would be tied together, and available to be called upon for any emergency such as pumping water in the event of a great fire.

In reply to a question as to the capacity of the present generating station at Lockport, Mr. McCormick said that the estimated capacity is 32,000 kilowatts, but owing to water supply, that amount could not be generated at the present time.

John Mabbs asked the speaker if the Sanitary District could generate enough current to supply the street railways. Mr. McCormick answered in the negative.

F. J. Postel asked why the comparatively new Thirty-ninth Street pumping station was not designed as an electrical station. Replying, Mr. McCormick said that the original contracts for this station were let before the generation of current was proposed.

Homer E. Niesz closed the remarks, complimenting the speaker on his interesting address.

### Viaduct Company Extending.

The Inter-City Viaduct Company, which owns the toll viaduct between Kansas City, Mo., and Kansas City, Kan., the bonds of which are largely held in Boston, has applied to the city council of Kansas City, Mo., for a franchise for an extensive switching system in the north end wholesale and manufacturing district and over viaducts in the west bottoms. The viaduct as it stands is not a profitable investment, but with the new plan it is believed it can be made a good paying property.

The switching is to be done with electric locomotives and practically every railroad in the city will be reached by it, as well as the levee warehouses of the new Kansas City-St. Louis Steamboat Company. The company offers to pay the city two per cent of its gross receipts.

### Sherbrooke Railway and Power Company.

The Sherbrooke Railway and Power Company will shortly issue $600,000 of bonds for the erection of a new power plant and extension to the traction system. The issue will be made by McCuoig Brothers & Company, of Montreal.

### An Exposition at Des Moines.

An exposition of municipal administration as exemplified by the Des Moines Plan will be held at Des Moines, Ia., Tuesday, June 14. One of the most important features of this exhibition will be laying the corner stone of the new municipal building.

## AMERICAN SOCIETY OF CIVIL ENGINEERS.

PROGRAMME OF ANNUAL CONVENTION IN CHICAGO.

The forty-second annual convention of the American Society of Civil Engineers will be held in Chicago, Ill., June 21, 22, 23 and 24. The programme, which is given below, includes visits to electrical manufacturing and operating plants.

*Monday, June 20.*—An informal reception will be held during the evening at the Congress Hotel, in order to enable those who arrive early enough to become acquainted with the Chicago membership and with each other.

*Tuesday, June 21, 10 a. m.*—First meeting. John A. Bensel, president, will deliver the annual address, at the close of which the business meeting will be held. The business to be considered will be as follows: (1) The time and place for holding the next annual convention. (2) Report of a special committee appointed to formulate the general lines which should be followed in legislation affecting the practice of engineers. (3) Report of the Board of Direction in the matter of a proposed special committee to report upon the preservation of wood.

*Tuesday, 2 p. m.* — Automobile drive through part of the park system of Chicago, the entire party being guests of the local membership.

*Tuesday, 8:30 p. m.*—Second meeting. This will be held either in the Florentine Room of the Congress Hotel, or in Fullerton Hall of the Art Institute. Alfred Noble, past-president, will describe the New York Tunnel Extension of the Pennsylvania Railroad, illustrating his description with lantern slides.

*Wednesday, June 22.*—The day will be devoted to a visit to the new steel plant of the United States Steel Corporation at Gary, Ind., the party leaving Chicago at about 9:30 a. m., either by special train or by steamer. Luncheon will be served during the trip. The steel plant will be inspected, and those who are especially interested will be given an opportunity to inspect the waterworks, sewerage and other municipal improvements of this new city.

*Wednesday, 8:30 p. m.*—Third Meeting. J. Waldo Smith will address the society on the subject of the new water supply for the City of New York. The address will be illustrated by lantern slides.

*Thursday, June 23.*—For this day a number of short excursions to local points of interest will be arranged. Parties will be made up according to individual preference, and will be personally conducted. The following trips will be arranged for: (1) Excursion to Lockport, to inspect the regulation works and power plant of the Sanitary Canal. (2) Visit to the Chicago and Northwestern Railway Passenger Terminal now under construction. (3) Inspection of the plant of the Commonwealth Edison Company. (4) Visit to the new mail order plant of the Sears-Roebuck Company. (5) Visit to the new plant of the Western Electric Company.

*Thursday, 8:30 p. m.*—Fourth Meeting. An illustrated lecture will be delivered descriptive of the plans recently perfected for beautifying the City of Chicago. After adjournment of this meeting members are invited to a smoker at the Chicago Engineers' Club.

*Friday, June 24, 10 a. m.*—This day will be devoted to an excursion. The party will

first visit the Army Post at Fort Sheridan, and will then inspect the new Naval Training School at Lake Bluff. Luncheon will be served during the trip, and Ravinnia Park will be reached early in the evening. Here dinner will be served and there will be a concert, and probably informal dancing.

The privileges of the Chicago Engineers' Club (First National Bank Building, 15 Plymouth Place) have been, by special resolution, extended to the membership of the society attending the convention, and it is understood that rooms may be secured at this club.

### New Submarine Lighting-Cable.

The American Steel and Wire Company recently laid what is said to be the first long-distance submarine cable for high-voltage transmission in an inland lake. The cable was laid on the bottom of Oneida Lake, New York, from a point several hundred feet east of the South Bay terminal of the Syracuse and South Bay Electric Railroad to the east shore of Frenchman's Island, a distance of more than 6,000 feet. It is three-conductor No. 5 B & S gauge, insulated with the maker's special crown-rubber insulation six thirty-seconds of an inch wall around each conductor, with jute laterals and wound with two reversed saturated jute servings. It is armored over all with No. 9 galvanized cable iron wire.

Power will be transmitted at 6,600 volts and stepped down to 110 volts at the island, where it will be used principally for illuminating the dancing pavilion, groves and dock at the resort.

### Ocean Telegraph Lines.

The following notes on new wireless and cable lines are from Consul Solomon Berliner, of Teneriffe, Canary Islands:

From experiments in the different colonies, it is contemplated to establish wireless stations in German East Africa, Togoland, Kamerun, and German Southwest Africa, also between the different German South Sea colonies.

The wireless telegraph station at Santa Cruz de Teneriffe is finished. There have been many trials and more are still going on between Cadiz and Paris; some of these have been satisfactory, but the results are not as successful as expected. The station at Gando, Grand Canary is also finished and the trials there are about the same as those at Teneriffe. It seems that the messages received can not be read very correctly.

The cable connecting Monrovia with Pernambuco is in course of construction and I am informed will be ready in July, when the German vessel will take it aboard and start for Monrovia to lay it. The company expects to have a through cable from Emden, Germany, via Teneriffe, Monrovia, to Pernambuco, Brazil, open to the public by the end of October, 1910.

### Expenses and Revenues of New York Electric Railways.

E. F. Peck, general manager of the Schenectady Railway Company, Schenectady, N. Y., recently compiled the operating and revenue statistics of the railway companies of New York State, outside of New York city, and under the jurisdiction of the Public Service Commission, Second District. The Street Railway Association of New York sent an arrangement of these statistics to newspapers about the state and as the figures are of interest, says *Engineering News*, they are reprinted with slight rearrangement in the accompanying table.

EXPENSE AND OPERATING STATISTICS OF ELECTRIC RAILWAYS IN NEW YORK STATE FOR YEAR ENDING JUNE 30, 1908.

| | Largest ten companies. | | | Seventy-four companies. | | |
|---|---|---|---|---|---|---|
| | Total. | Per cent of operating revenues. | Distribution of five-cent fares. | Total. | Per cent of operating revenues. | Distribution of five cent fares. |
| General expenses, including insurance, etc. | $ 934,988 | 06.19 | 0.309 | $ 1,551,335 | 07.32 | 0.366 |
| Cost of power | 1,677,716 | 11.12 | 0.556 | 2,608,705 | 12.31 | 0.615 |
| Conductors and motormen | 3,217,439 | 21.32 | 1.066 | 4,351,391 | 20.53 | 1.027 |
| Other transportation and traffic expenses | 1,112,718 | 07.37 | 0.369 | 1,558,187 | 07.35 | 0.367 |
| Maintenance of way and structures | 1,187,445 | 07.87 | 0.393 | 1,754,505 | 08.28 | 0.414 |
| Maintenance of equipment | 941,991 | 06.24 | 0.312 | 1,422,599 | 06.71 | 0.336 |
| Damages and legal expenses | 734,844 | 04.87 | 0.244 | 884,625 | 04.17 | 0.209 |
| Rentals | 140.239 | 00.93 | 0.046 | 214,567 | 01.01 | 0.050 |
| Taxes | 763,290 | 05.06 | 0.253 | 1,046,913 | 04.94 | 0.247 |
| Interest | 2,633,101 | 17.45 | 0.873 | 4,270,515 | 20.15 | 1.008 |
| Total operating expenses | $13,343,771 | 88.42 | 4.421 | $19,663,342 | 92.77 | 4.639 |
| Operating revenue | 15,091,299 | 100.00 | 5.000 | 21,194,486 | 100.00 | 5.000 |
| Surplus | 1,747.528 | 11.58 | 0.579 | 1,531,144 | 7.23 | 0.361 |

### Changes in Electrical Rules in New York City.

Beginning June 1, 1910, the following additonal rule relating to garages becomes effective:

31-C—Garages.

a. Rigid iron-conduit system must be employed.

b. Cutouts and switches must be inclosed in metal boxes placed at least five feet above the floor level.

c. Switchboards and charging panels must be located in a room or inclosure provided for the purpose.

d. For portable lights, flexible cable designed for rough usage must be employed, this cord carrying the male end of a ten-ampere pin plug connector, the female end of which is hung from a cable of the same type securely attached to the cover of the outlet box and of such length that the connector will hang freely at least five feet clear of the floor. For all portable lights, keyless molded-mica sockets, equipped with handle, hook and guard, must be employed.

e. For charging, theatre-stage cable must be employed, this cable carrying the female end of a fifty-ampere pin-plug connector, the male end of which is hung from a cable of the same type securely attached to the cover of the outlet box and of such length that the connector will hang freely at least five feet clear of the floor, the male end of the connector being protected against accidental contact by a shield or petticoat.

f. Motors must be of the inclosed type and located not less than five feet above floor, or must be inclosed in an approved fireproof room, shut off from main building.

### Italian Hydroelectric Developments.

Thirteen concessions for the development of hydroelectric power in the Department of Piedmont, Italy, totaling 21,784 horsepower, were granted during 1909, against twenty-four concessions of 13,582 horsepower in 1908. The most important of the concessions of 1909 was for the development of 18,507 horsepower, for industrial purposes, in the Province of Cuneo.

### Telephones for Train Service.

The work of installing telephones on the Spokane division of the Great Northern Railroad has been completed. The company now has 2,700 miles of road on which all trains are operated by telephone. It is expected that by the end of the year all the trains on the main line will move under telephone orders.

The division between St. Paul and Breckenridge has been run by telephone for more than two years. A number of branches will be fitted out in the same way this year. The Northern Pacific has 500 miles under this new service.

### New Cable Opened.

The new cable line of the Western Telegraph Company connecting Europe with Buenos Ayres, Argentina, by way of Ascension Island, was opened a short time ago. It is said to be the second longest cable in the world.

# CENTRAL-STATION PRACTICE

## Transmission—Interior Wiring

### A PRODUCER-GAS POWER PLANT.

DESCRIPTION OF THE EQUIPMENT AT AN ENGLISH RAILROAD COMPANY'S CARRIAGE WORKS.

The great possibilities for producer and gas-engine plant for small power stations in certain cases have been realized only during the last few years, and many small central stations and isolated plants using this type of equipment are being successfully operated at good efficiency both in this country and abroad. A typical example of recent English practice in this connection occurs at the carriage and wagon works of the Great Western Railway, Swindon, England. We are indebted to our London contemporary, *Electrical Engineering*, for the details of this plant, and to the Campbell Gas Engine Company, Ltd., of Halifax, England, for the photographs from which our illustrations were reproduced.

Although a considerable amount of electric driving has been a feature of the locomotive works of the Great Western Railway for some time, it is only recently that a beginning has been made in the use of electric power in the adjoining carriage and wagon works. The arrangements at the latter works, however, which include a new power station equipped with a large suction producer gas plant, are of considerable interest even if the number of motors installed is not yet very large. The older station at the locomotive works is also equipped with gas engines, but these run on lighting gas. The last engine to be put down there, a 250-horsepower vertical engine, supplied by the Campbell Gas Engine Company, of Halifax, is of similar type to those described below in connection with the new station and running on producer gas, so that when these have been running a while an interesting comparison will be able to be made. The older engines at the locomotive works, also of 250 horsepower, are six in number, and were supplied by the British Westinghouse Company. It is, however, more particularly the purpose of this article to describe the equipment of the carriage and wagon works.

The new power house consists of a compact building divided into producer room and engine room, and with fuel storage accommodation at one end. The present equipment is of 500 brake horsepower, but the building will accommodate a further 250-horsepower set. The station is primarily intended for the needs only of the carriage and wagon works, and should be sufficient for the demand for some time to come, but interconnection between it and the power station at the locomotive works at a future date is contemplated.

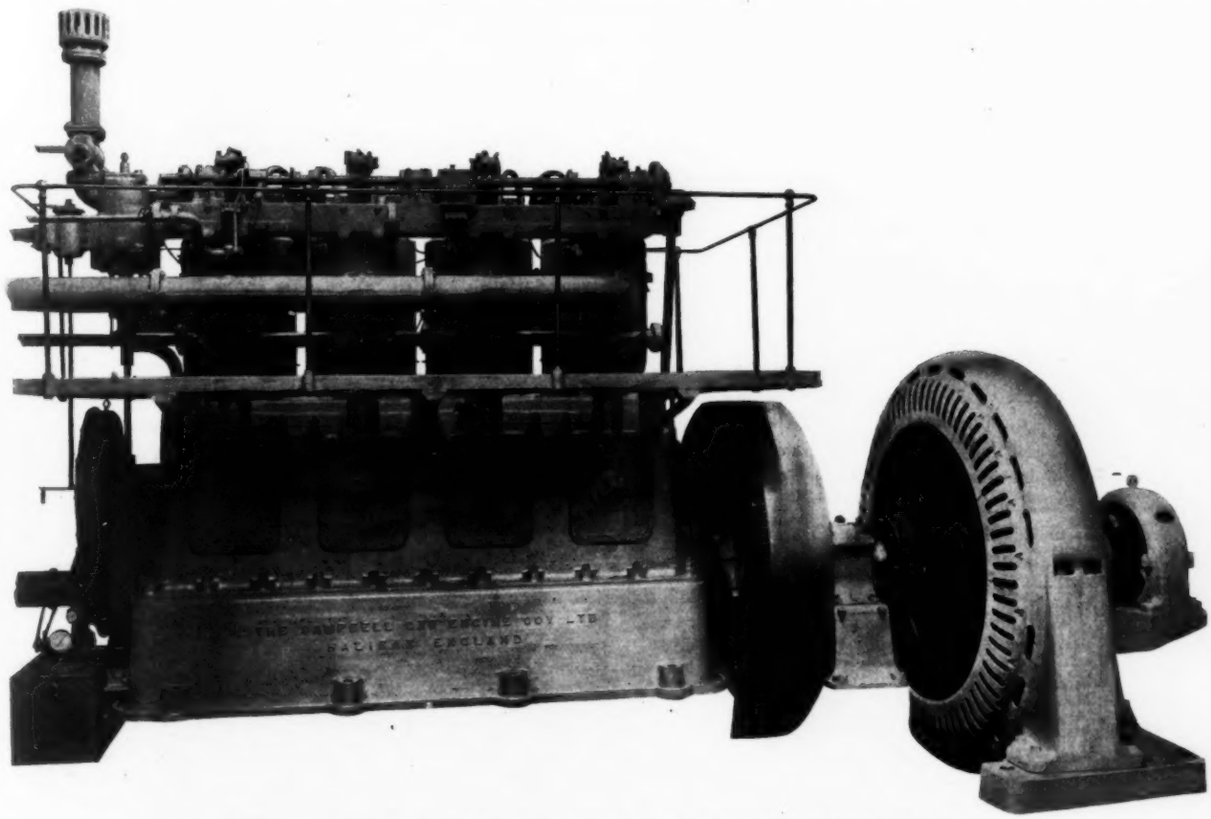
The fuel storage stage is sufficient to hold a several weeks' supply. Only the best anthracite is used, the price paid at present being $5.10 per ton. An elevated firing platform enables the fuel to be shoveled direct into the charging hoppers of the producers. At present one charge of about 225 pounds every three-quarters of an hour is sufficient to deal with the light load. Only one producer is kept going at a time, and the plant usually works considerably below half load.

CAMPBELL GAS PRODUCER.

The producers themselves are interesting as being among the largest which the Campbell Gas Engine Company have yet put to work. Each is rated at 250 brake horsepower, and they are entirely independent, having even separate chimneys for blowing off. Ample ventilation of the producer room is secured by one side being open to the air. Each producer is six feet three

inches in height and three feet nine inches internal diameter, and is provided with two scrubbers, each sixteen feet high by three feet six inches diameter.

The essential parts of the Campbell suction producer are the actual producer where the gas is generated, the vaporizer or evaporator where steam is produced, the superheater where the air and steam are further heated before entering the producer, and the coke scrubber where the gases are cooled and purified. The generator body is made of riveted steel plate, and has doors on either side to facilitate the clearing away of ash and clinker. The lining is of special firebricks, with a packing of sand between them and the generator body. The ashpan is separate, and is of cast iron, as this resists corrosion better than steel. The vaporizer is placed directly on the top of the generator, and is arranged to allow for expansion and contraction, and to be easily opened out for cleaning. The superheater is between the producer and the scrubber, and also acts as a separator, removing a large proportion of the dust from the gas before it enters the scrubber. The scrubbers in the Campbell producer plants are of particularly large size in order to insure the thorough purification and cooling of the gas without frequent changing of coke. As in the ashpan of the generator, the lower part is made of cast iron on account of its better ability to resist corrosion, as the water which falls to the bottom of the scrubber is slightly acid. All controlling valves are of the screw-down type, as it has been found that plug cocks have a tendency to stick. The gas box from which the engine draws its supply is provided with a safety test-cock to enable the quality of the gas to be tested before starting the engine.



CAMPBELL GAS ENGINE DIRECT-CONNECTED TO ELECTRIC GENERATOR.

The generating sets are two in number. Normally each engine works off its own producer, but cross-connecting pipes are provided so that either or both engines may be supplied from either producer if necessary.

Each engine is designed for a normal load of 250 brake horsepower, but is capable of a maximum load of 290 brake horsepower, and is of the Campbell Engine Company's vertical four-cylinder type, running at 225 revolutions per minute, a speed considerably lower than Messrs. Campbell's standard speed with this class of engine, but adapted so that they could run at the same speed as the existing engines in the locomotive works. Each cylinder is seventeen-inch bore by twenty-inch stroke. The crankshaft is eight and one-half inches diameter, with a total length in bearings of no less than fifty-seven inches. Each engine is fitted with a five-ton flywheel seven feet six inches diameter, and the guaranteed coefficient of fluctuation per revolution is 1/150. The governing is guaranteed to be within five per cent from full load to light load, and within two and one-half per cent as regards permanent variation of speed. The mechanical efficiency of each engine is given as eighty-five per cent.

The engines work on the ordinary four-stroke cycle, and are single-acting. The cylinders are entirely independent of one another, so that in case of accident the engine may be run with one or more cylinders idle. An important point in the arrangement of the valve gear is that this is quite clear of the cylinder covers, which can be removed

and replaced in a few minutes. The engines are provided with two camshafts, one inside the crank chamber for the exhaust valves, and the other running across the top of the cylinder, and operating the magneto ignition gear and the inlet valves. Governing is effected entirely on the quantity system by acting on a throttle valve, and hand adjustment enables small changes in speed to be made while running. No variation of the air adjustment is made by the governor. The ignition of these engines is on the low-tension magneto system, and each cylinder has its own separate magneto and tappet gear. An adjusting gear is provided, so that the time of ignition can be varied while the engine is running, and on the erection of the engines the utmost care was taken in synchronizing the ignition of all the cylinders to insure steady running by taking indicator cards. Forced lubrication is used throughout, and the pressure is produced by a submerged valveless ram pump driven by eccentrics on the crankshaft. The water circulation is taken direct from the mains. The exhaust valves are water-cooled, and at times of heavy load a water spray can be turned on in each cylinder, and in the exhaust pipe. Starting up is effected by compressed air in one cylinder in the usual way.

Each engine is coupled directly to a six-pole continuous-current generator of the General Electric Company's standard type, made at Witton, Birmingham. The armatures of these machines are bolted right up to the engine flywheels without intermediate bearings. Each machine is capable of an output of 150 kilowatts at 250 volts when driven by the engines at 225 revolutions per minute, and is compound-wound. They have not been fitted with commutating poles, as they are amply large enough for the work under the conditions of speed and voltage, and can work with constant position of the brushes at all loads.

The General Electric Company has also supplied recently a similar machine for the station of the locomotive works. The switchboard was constructed by the Great Western Railway Company's own staff, and is of very simple, straightforward design. At present only two generator panels and two feeder panels, giving accommodation for four feeders, are equipped, but blank slate panels are in place for one further generator and four additional feeders. There is a single pair of bus-bars, and the transmission is on the two-wire system at 250 volts. Each generator panel has a three-pole automatic circuit breaker, supplied by R. W. Blackwell and Company, which acts as combined double-pole main switch and equalizing switch for the compound winding. No fuses are used either in the generator or feeder circuits, so that the feeder panels only contain double-pole automatic cut-outs, of the British Thomson-Houston Company's design, and the necessary ammeters. The shunt-regulating rheostats are worked by handwheels on the lower part of the board, where there is also a total-output meter. An Evershed leakage indicator with push buttons for testing the insulation of the two sides of the circuit separately is mounted on the wall near the board.

Four two-wire 250-volt overhead feeders, consisting of covered cable supported on messenger wires from wooden poles, leave the power station, and are taken direct to the carriage-fitting shop, the carriage-lifting shop, the road-wagon shop, and the wagon-lifting shop. In the first three of these, motors are already at work, and the equipment of the last is to be proceeded with shortly. The introduction of electrical driving is being made gradually as occasion offers. It is intended ultimately to adopt electric motors practically throughout the works, except for such machinery as is already hydraulically actuated or in such special cases as in the stamping shop, where steam is obtained from waste heat from the furnaces.

### Southern Power Company's Excursion.

The Southern Power Company for the second time this spring ran an excursion to its model hydroelectric plant at Great Falls, about forty-four miles south of Charlotte, on the Catawba River, carrying the members of the American Cotton Manufacturers Association to that point on a special train. The company is now supplying electric power to scores of cotton mills in this territory, and the manufacturers were given the full benefit of a thorough examination of the plant. The first trip was made on April 1, when the American Institute of Electrical Engineers were the guests of the company on a similar excursion.

### New Power Plant in the South Near Completion.

The dam and power house of the Paulding County Power Company, six miles from Dallas, Ga., are expected to be fully completed shortly. This plant will furnish current for operating the mill of the Paulding County Cotton Manufacturing Company, for lighting the town of Dallas, and for supplying electric power to various small enterprises. The dam is of rock and concrete, about 200 feet long by fifty feet high, and the entire development will cost in the neighborhood of $50,000.

### A Peculiar Case.

Palermo, a township in Butte County, Cal., is in the peculiar position of having to use kerosene for illumination, although the transmission lines of three great power companies (Great Western, 150,000 horsepower, Pacific Gas and Electric, 11,000 horsepower, and Oro Water, Light and Power, 5,000 horsepower) pass directly through it. It is reported, however, that the Oro company will shortly proceed to alleviate this lamentable state of affairs by installing a local substation and distribution system.

### Train Dispatching by Telephone.

The Block Signaling and Train Control Board has been gathering data on the use of block signals on the railways of the United States. Incidentally it also compiled data as to the extent that the telephone is used on American railroads for train dispatching. According to the report the telephone is used on about 290 railroads having a total mileage of 131,014, of which 26,344 has been equipped with the telephone service. This ratio is constantly increasing, as also the number of railroads on which the telephone is being used.

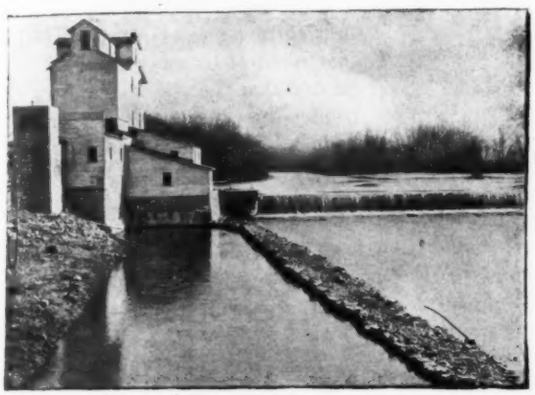
### Favors Underground Wires.

Mayor Davidson, of Wichita, Kansas, is reported to have stated that he is in favor of an ordinance requiring that all telephone, telegraph and electric light poles be removed from Main Street and Douglass Avenue, in that city.

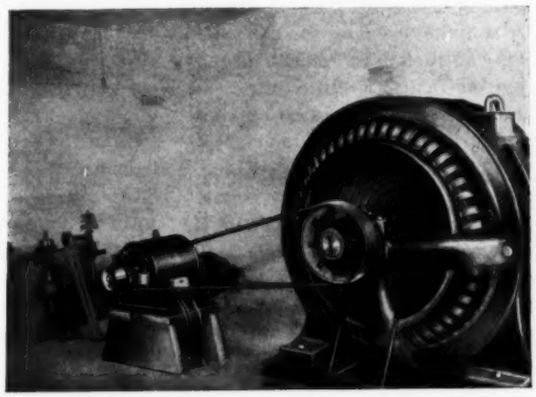
A recent report from England states that the ballroom of the Mansion House at Doncaster is to be heated by electric radiators.

### A Small Low-Head Hydroelectric Plant.

As an example of what can be done in the way of developing power from streams with only a small available fall, the hydroelectric plant of the Empire Electric Power and Supply Company, of Carthage, Mo., is of interest. The "Forest Mills" power plant of this company, located on Spring River, six miles east of Carthage, is now developing 100 kilowatts on a seven-foot head of water and is designed to give double that output at any time the demand for power warrants the addition of the necessary generating apparatus.

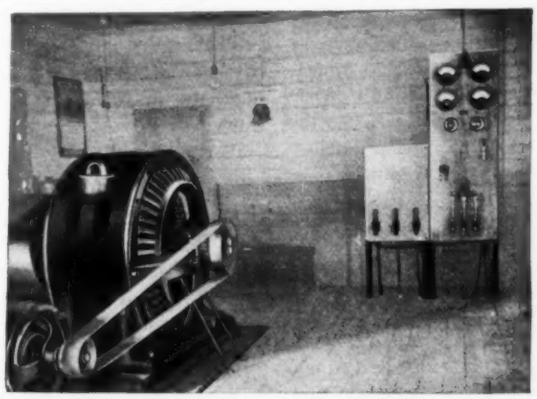


THE FOREST MILLS POWER PLANT.



ALTERNATOR, EXCITER AND WATERWHEEL GOVERNOR.

As indicated by its name, this plant occupies an old mill site, the mill building having been remodeled to suit the new conditions and the dam relaid in concrete. The forebay was enlarged and deepened, a new concrete penstock put in and accommodations made in the building for four forty-five-inch waterwheels together with a suitable generating equipment.



ALTERNATOR AND SWITCHBOARD.

The present (one-half of the ultimate) hydroelectric equipment consists of two forty-five-inch Leffel turbines, belt-connected to a 100-kilowatt, three-phase, sixty-cycle, 440-volt Hawthorn generator, running at 600 revolutions a minute, together with three transformers and a switchboard for controlling this apparatus.

The voltage is stepped up at the power house to 6,600 and is transmitted six miles to the company's station in the heart of the business district of the city. Here the voltage is stepped down to 440 to supply a Hawthorn seventy-five-kilowatt, motor-generator set, which feeds the 220-volt, direct-current power circuits. It might be well to state here that the Empire company furnishes current for power only, a municipal plant operating the lighting system, and its total demand is, therefore, comparatively small.

There is also at the city station a 150-horsepower, three-cylinder, vertical, 280-revolutions-per-minute, Rathburn-Jones natural-gas engine, direct-connected to a 100-kilowatt, 220-volt, direct-current, Hawthorn generator, of Western Electric manufacture, and a smaller gas-engine generating unit. Whenever the power demand is greater than the output of the hydroelectric plant, one or both of the gas-driven units are run in parallel with it, giving a total station output of 225 kilowatts.

No trouble whatever has been experienced in paralleling the gas-engine and waterwheel-driven systems, and the governors on the turbines have always maintained good voltage regulation.

### Forest Products Laboratory Opens.

The new forest products laboratory at Madison, Wis., just completed at a cost of $50,000, was formally opened and dedicated Saturday, June 4. A program consisting principally of addresses by Charles R. Van Hise, president of the University of Wisconsin, Governor Davidson, Henry S. Graves, chief forester, and several representatives of lumber and wood consumers' organizations, was aranged for the occasion.

All departments of the laboratory will be ready to begin their experimental work in a short time, and the experiments which will be carried on will be of great importance to all wood users. M.

### Examination for Engineers.

The United States Civil Service Commission announces an examination will be held on July 13-14 to secure eligibles from which to make certification to fill a vacancy in the position of engineer in the Indian Service, at the White Earth School, Minn., and other vacancies as they may occur. Owing to the widely varying conditions in the various schools, an examination will be given in the following branches: steam engineering, electrical engineering, heating, refrigeration, gas and gasoline engines, and hydraulics. An applicant may take one or more than one of these at his discretion.

## NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION.

PROGRAMME OF THE ATLANTIC CITY CONVENTION.

The National Electrical Contractors' Association will hold its tenth annual convention this year at Atlantic City, N. J., July 20, 21 and 22. The programme, as announced by the *National Electrical Contractor*, the official organ of the association, is as follows:

Headquarters and registration bureau will be established at Young's Hotel, Boardwalk and Tennessee Avenue, opposite Steel Pier.

*July 19.*—Directors' meeting, Young's Hotel, 10 a. m.; rejuvenation of Sons of Jove, 9 p. m.; registration bureau at Young's Hotel opens at 5 p. m. on this day.

*July 20.*—Open session in "The Chapel," Young's Pier, 9:30 a. m.; address of welcome by the Mayor of Atlantic City and a representative of the New Jersey State Association; reply by G. M. Sanborn, president of the National Association; two speakers on subjects of interest to the trade; sea bathing, Reid's Bath House, Boardwalk near Ohio Ave., for everyone at 11:30 a. m. (coupon on ticket secures bathing suit); business session for members only in "The Chapel," Young's Pier, 2 p. m.; roller-chair ride for ladies and guests, starting from Young's Hotel at 3 p. m.; smoker for guests and members at New Berkeley at 8 p. m.; ladies' trip to Million Dollar Pier starting from Young's Hotel at 8 p. m.

*July 21.*—Open session, "The Chapel," Young's Pier, 9:30 a. m.; three speakers of prominence in the industry; business session for members only in "The Chapel," Young's Pier, 2 p. m.; trolley ride to Ocean City for ladies and guests starting from Virginia Avenue and Boardwalk at 2 p. m.; dinner for ladies, Young's Hotel, 6 p. m.

*July 22.*—All-day outing at Inlet for everyone; cars leave Young's Hotel at 11 a. m.; sports, ball game and other events, at 1 p. m. (the sports are in charge of E. McCleary of Detroit, Michigan, and James R. Strong of New York city, and announcement of the events will be made on the grounds); shore dinner, 4 p. m.; band concert all the afternoon.

TRANSPORTATION.

A reduced rate of fare and three-fifths, to those attending the convention, has been authorized only by:

(1) The Trunk Line Association, covering territory extending from Old Point Comfort west to Huntington, W. Va., following the Ohio State line from this point to Salamanca, N. Y., thence to Niagara Falls and Rouse's Point, and south to Old Point Comfort; not including any points in Virginia, Kentucky or Ohio.

(2) The New England Passenger Association, covering territory including the states of Maine, New Hampshire, Vermont, Massachusetts, Connecticut and Rhode Island.

(3) The Central Passenger Association, covering the States of Indiana and Ohio, Michigan as far north as Mackinaw, and the cities of Meadville, Warren, Oil City, Franklin, Allegheny and Pittsburg, Pa.; also that part of Illinois southeast from St. Louis to Cairo and north to Chicago.

The Eastern Passenger Association, Southwestern Passenger Association and Western Passenger Association have not considered it advisable to authorize any reduced rate of fare, but the Western Passenger Association explains that the fares in a large part of their territory are now on the basis of two cents per mile, and if passengers from their territory desire to take advantage of the reduced rate authorized by other associations they may do so by purchasing full-fare tickets to Chicago, Peoria, or St. Louis, and then repurchase to Atlantic City at the reduced rate.

Attention is called to the summer tourists' tickets which will be on sale from practically all large points in the Western and other associations, to Chicago, St. Louis and Atlantic City, and which may be taken advantage of by persons attending the meeting.

It should be remembered, however, that the reduced rate of fare and three-fifths, granted by the passenger associations above indicated, has been authorized on the basis of one hundred persons purchasing full-fare tickets on the certificate plan, each of which tickets shall cost not less than seventy-five cents. Therefore, while passengers may reduce their own individual fares by purchasing tourist or so-called excursion tickets to Atlantic City, they thereby reduce the chance of obtaining reduced rates to all of those members who purchase their tickets on the certificate plan.

### The Anglo-French Telephone Cable.

The new Anglo-French telephone cable was completed on May 29 last, and a series of experiments on its speaking value are being made by the British Post-office engineers, before the cable will be opened for public use.

### Census Report of Electric Light and Power Stations.

The second Census Bureau report, prepared in conformity with the act of Congress of June 7, 1906, providing that statistics concerning central electric light and power stations shall be collected by that bureau at quinquennial periods, is now in press.

In Director Durand's letter of transmittal to Secretary Nagel of the Department of Commerce and Labor, it is stated that the statistics were collected under the supervision of Wm. M. Steuart, chief statistician for manufactures in the Census Bueau. T. Commerford Martin, of New York city, is credited with the authorship of the section dealing with the technical features of the industry. The analytical tables and textual verifications were made by Frank L. Sanford.

The report presents statistics concerning the physical equipment, service and financial operations of the stations mentioned. This census relates to the calendar year 1907 and it is the second census of the central-electric stations that has been taken since the Census Bureau was made a permanent office. The first covered the calendar year ending December 31, 1902. In order to preserve the comparability of the data the same form of schedule was used to collect the statistics of both censuses and the same form of presenting the data has been followed in both reports.

The report is in eight chapters and to these are added general tables, appendices, maps, diagrams and illustrations.

### Coherer Action.

In a paper read on March 11 last, before the Physical Society of London, England, Dr. W. H. Eccles showed that the whole of the properties of coherers could be explained by the Joule and Peltier heat generated at the junction, and its effect on the resistances of the contacting materials.

### May Light Erie Canal.

There is a possibility that the State Department of Public Works of New York may light the Erie Canal from the Tonawandas to Albion by electricity. Those who conceived the idea figure that the State will be able to use the surplus water at the Lockport locks to develop power for the system.

# TELEGRAPHY—TELEPHONY, and WIRELESS.

## A TELEPHONE RELAY.[1]—II.

BY S. G. BROWN.

During some experiments with the telephone relay attempts were made to dispense with the regulating winding and form the microphone by the mere

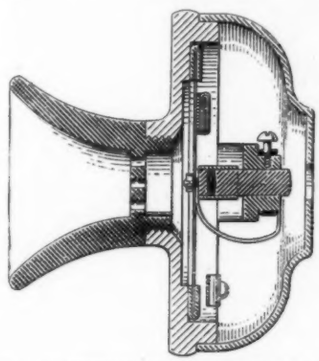


FIG. 5.—OSMIUM-IRIDIUM GRANULAR TRANSMITTER.

pressure of the electrodes one against the other as with carbon. With gold, platinum, palladium, and rhodium, it was not possible to do so. On the contrary, a microphone could be formed by light pressure between the following: Iridium, ruthenium, osmium, and osmium-iridium alloy. They are arranged advancing in the order of their effectiveness, which likewise is the order of their hardness. With iridium the action was only just shown, while osmium-iridium alloy makes a microphone that can carry large currents, stand high temperatures, and is exceedingly sensitive to small changes of pressure. This alloy is by far the best of the whole series, as it is the hardest, and although expensive, can be readily purchased as natural grains or granules, sifted to any desired uniform size. As regards the effectiveness of carbon, I should be inclined to include it in the series between iridium and ruthenium. The chemical properties of carbon, ruthenium, and osmium have likewise much in common, in that they resist the action of all acids, and are carried off as a gas by oxygen when strongly heated.

Ruthenium and osmium are of little value for microphonic purposes if purchased in their commercial form as grains or powder. The grains must be first fused into a bead and then crushed into granules. This may account for the failure of previous experimenters who, in their endeavor to compete with carbon, tried nearly everything that could be mentioned, including ruthenium and osmium, but without success.

Several "solid back" transmitters have been taken and altered in various ways to make use of the new metal. In one case the ordinary carbon electrodes were entirely removed and replaced by sheet iridium-faced ones three-sixteenths of an inch in diameter; these electrodes were separated by a distance of one-twentieth of an inch,

FIG. 7.—TELEPHONE RELAY IN BRASS CASE WITH UPPER ARM RAISED FOR CLEANING THE CONTENTS.

and the space between was nearly filled by three grains weight of very fine granules of osmium-iridium kept in place by a rubber tube. This new transmitter would take permanently a current of three quarters of an ampere from a two-volt accumulator. It was connected to the telephone service through a large transformer, which had a low-resistance primary of only one-

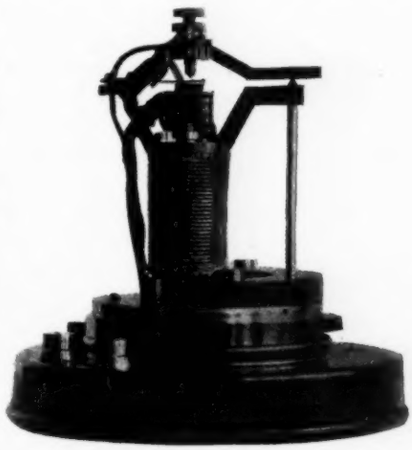


FIG. 6.—THE TELEPHONE RELAY.

tenth of an ohm. The ordinary carbon transmitter, supplied in the usual way from the central battery, was kept in position in series for purpose of comparison.

The results of several trials were as follows: Speaking on both occasions with equal force, first, directly into the mouthpiece of the carbon transmitter, secondly twelve inches away from the mouthpiece of the metal transmitter, the same volume was given in the receiving telephone. When the new transmitter was spoken into at a distance of three inches the sound was two or three times louder than is at present normal, and when spoken into directly, the sound at the far end was uncomfortably loud and the voice could be heard with ease three yards away from the receiver. In all cases the articulation was clearer and crisper with the metal than with the carbon transmitter.

The first difficulty to contend with occurred after the instrument had been in use some months. This was a gradual weakening of the power of transmission, which was eventually found to

[1] Abstract of a paper recently presented before the Institution of Electrical Engineers, London, Eng

be due to the iridium faces of the electrodes becoming superficially oxidized. To remedy this the iridium has been replaced by gold, which so far has proved satisfactory. Another improvement was to cone inwards the faces of the gold electrodes; this is to prevent the granules from unpacking, as they had previously a tendency to do when worked between plane faces.

An osmium-iridium granular transmitter has been constructed embodying all these later improvements (see Fig. 5), the electrodes have a diameter of one-quarter of an inch, and it will work permanently with one ampere at two volts. When joined to the telephone circuit and spoken directly into, the distant receiver will respond with overpowering loudness. Such an instrument could be fitted in subscribers' premises where long-distance telephony was much in use, and distances could be spoken over which at present offer considerable difficulties. Up to the present no regular long-distance tests have been made, but it has been tried over sixty miles of twenty-pound standard artificial cable, and will work over this length with clearness and reasonable loudness, showing that this was by no means the limit. In all these trials a local battery was used. As most of the transmitters in London are supplied with current from common or central batteries at the exchanges, it would be important to adapt the new instrument to this system, but up to the present nothing has been done in this direction. The metal transmitter has a low resistance; this would have to be raised by a suitable design to make it really successful. The amount of current received over the telephone wires at my house is only 0.06 ampere, supplied by, I believe, a twenty-two-volt accumulator, working through the 360 ohms of the line. On one occasion, as an experiment, the central-battery carbon transmitter was replaced by an ordinary low-resistance metal one, and at the far end clearer speech was obtained, which was as loud as before. The upper harmonics of the voice are more faithfully transmitted by the metal granules than by the carbon—this accounts for the superiority in the articulation. As metal replaced carbon in the incandescent lamp to improve the efficiency, it would be curious if it should be doing the same thing now with the telephone transmitter. A much smaller quantity of the metal powder or granules is required as compared with carbon, and its sensitiveness in resistance to small changes of pressure is much greater. The new material is therefore peculiarly adaptable for the purposes of a relay for use on telephone lines where moderate magnification only is required. Such a relay has been constructed using osmium-iridium powder as the resistance varying medium. It is simple in design, requires no adjustment, and so far gives a moderate magnification with good articulation.

Referring to the telephone relay, the efficiency of the microphone for speech transmission depends largely upon the metal employed for the contact. Experiments have been made with the following results. The metal must be unoxidizable. Thus materials like brass and aluminum are useless. If they partially oxidize like steel and silvers the magnifying power is small. With the following, good results were attained: Pt, Pd, Rh, Ir, Ru, Os, and osmium-iridium alloy. Carbon has been tried for one or for both of the contact-pieces; the magnifying power is then smaller than with the metals and less current can be sent through, due to its greater specific resistance. Gold, due to its complete absence of surface oxidization, makes an unstable contact, and the relay will buzz, very much after the fashion of an electric bell, under all ranges of adjustment. (Soft pure gold makes the best contact for an ordinary relay of any material that I am acquainted with.) Even with the metals of the platinum group the relay can be made to buzz by cleaning the contacts with a cloth, but stability of working can be again secured by oxidizing the surface, by exposure to the air, or, what is much better, by applying thin oil to the surfaces of the contact. The nearer the relay is to this buzzing point the greater its sensitiveness; it is therefore advisable to clean the contact so as to obtain the buzzing action and to stop the action by the application of a small drop of thin oil. The harder the contact metal used the clearer the speech through the relay. With soft platinum the higher harmonics are more or less absent, but with osmium-iridium the articulation is quite clear and crisp.

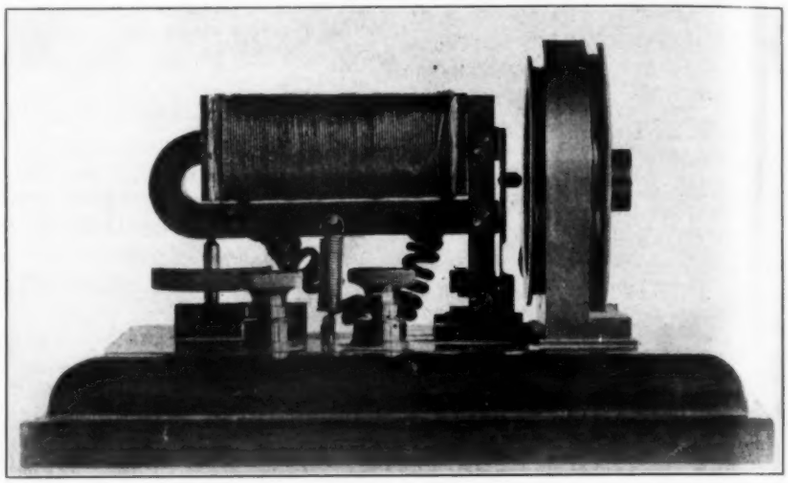


FIG. 8.—ELECTRICAL STETHOSCOPE.

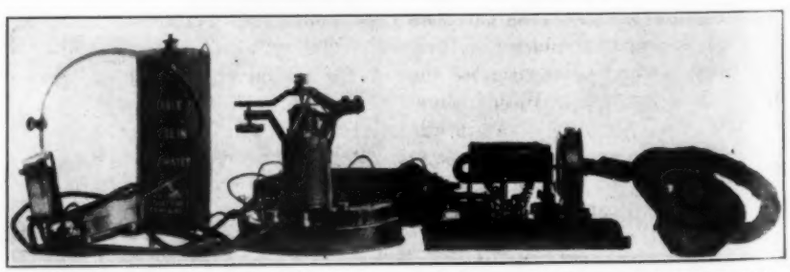


FIG. 9.—ELECTRICAL STETHOSCOPE AND TELEPHONE RELAY READY FOR USE.

Microphones are sometimes liable to produce faint bubbling and squeaking sounds; this is due, I think, principally, to want of hardness in the contact-pieces, especially if the upper bruises the lower piece. This sound can usually be stopped by shunting through a suitable resistance the winding of the telephone circuit. A microphone formed between two hard metals can touch only in one spot. As half the energy liberated from the local battery is normally dissipated at this point, the rise of temperature there may be very considerable. This heating puts a stop to any great handling of power by a single contact. For these reasons it is not advisable, with the normal voltage to pass more than, say, a quarter of an ampere; if the current is too great the sensitiveness will decrease with time; but if the current is kept small, say of the order of one-twentieth of an ampere, the delicacy may be perpetually maintained. It is fortunate that the harder varieties of the platinum group are the ones that are able to stand the higher temperatures.

The following rough tests of a special form of my telephone relay may be of interest, the resistance of the coil through which the current to be magnified passed was in this case 1,000 ohms. A current of 0.126 milliampere switched on through this coil, caused the local relay current to vary from three to 0.5 milliamperes, the contact volts from 0.36 to 1.19, the contact resistance, as calculated, from 120 to 2,370 ohms, and the measured movement of the reed at the place of contact $8 \times 10^{-6}$ inch. With the contact open and no local current, placing a ten-gramme weight on the reed near the contact produced a measured movement of $2.4 \times 10^{-5}$ inch. With the contact adjusted to pass four milliamperes, the ten-gramme weight cut the local current down to 1.5 milliamperes and produced a movement of $1.2 \times 10^{-5}$ inch, and with twenty-five milliamperes, the same weight reduced the current to twenty milliamperes and caused a movement of $0.6 \times 10^{-5}$ inch. We have thus the curious effect, that with a given applied force, increasing the local current cuts down the movement of the reed. Perhaps this accounts for the fact that, within wide limits, altering the resistance and thus the value of the current in the local circuit does not seem to change the magnifying power of the relay; this power is more a question of contact and voltage than anything else. If a telephone relay is required to have a high degree of sensitiveness the voltage of the local cell must be reduced to, say, half a volt. This low voltage can be secured by opposing an accumulator to a dry cell, but the arrangement can only be at the expense of the self-regulating power of the microphone.

A telephone relay, if placed simply in the middle of a long telephone line, can magnify the currents only in one direction—such a device is called a single repeater. The relay for practical use has therefore to be associated with balancing coils and placed in the line so that it may work in either or both directions—such a combination is termed a two-way repeater. In a two-way repeater the lines on each side of the coils have to be balanced one against the other, and anything that produces a variation, say leakage, will cause the relay to react upon itself and thus interrupt the conversation till the balance has been restored. Theoretically it would seem that the two-way repeater can be only one-quarter the efficiency of the single repeater. Although the one-way relay is now solved it will be seen that there is still much to be done before the two-way repeater is practicable.

### Higher Telephone Rates.

Increased rates for long-distance telephone messages went into effect at Cincinnati and vicinity on June 1, when new schedules were received by the local offices of the American Telephone and Telegraph Company from its New York headquarters.

The rates from Cincinnati to about fifty stations in Ohio are increased from five to twenty-five cents each. General advances were also put into effect from Columbus, Toledo and Cleveland, where the United States Independent Telephone Company formerly competed with the Bell lines.

### Magazine for Telephone Employes.

A magazine is to be issued in New York in the interests of the employes of the Bell Telephone system in New York and adjacent territory. It will not carry advertising or encroach on the field of trade journals, but will discuss subjects that interest the telephone operator, the lineman and others.

### Chicago Telephone Situation.

In discussion of the expert's report on the Chicago Telephone Company, Bernard E. Sunny brought out some interesting facts regarding the cost of telephone service, especially with respect to the cheaper class of service. Mr. Sunny said in part:

"Th experts' report assumes that rates of each class of service ought to bear relation to the cost in each case. If rates of all classes were raised in proportion to expenses there would be an increase of fifty per cent to the 80,000 subscribers who have the cheaper class of service. The rate is prohibitive and most of the telephones would have to be taken out."

W. B. Jackson, expert engineer, tells the committee on gas, oil and electric light that the plant is practically new and with a depreciation of seven per cent, as allowed by the experts, could be rebuilt in twenty years. He estimates the life of a telephone at fourteen years.

How far the experts went in their conclusions is seen in the following extract from the report:

"Although the company has many millions of dollars invested in property in the city of Chicago, which is gradually depreciating, but has not yet reached the condition when it must be replaced by new apparatus, yet they are unable from the service which they render by means of that property to pay returns on their investment of a little less than eight per cent, namely 7.74 per cent, and set aside a reasonable sum toward the renewal of this apparatus when it becomes worn out or obsolete and for meeting the reconstruction expenses which will be imposed when the street railway subways are built.

"In other words, with the rates that are now in force the company will reach a time when it will be impossible for it to provide the city adequate service on account of lack of funds to replace worn-out or obsolete apparatus.

"It is also to be observed that the classes of service paid for at a fixed rate per year, without count of messages (including the commuted trunk circuits of the private branch exchanges), are uniformly unremunerative and in most instances do not pay for the current annual expense and depreciation, without any provision for return on the investment."

## A TYPICAL RATE PROBLEM IN SMALL TELEPHONE PROPERTIES.—II.

BY FRANK F. FOWLE.

The scientific study of a rate problem depends upon having full and accurate information in regard to the value of the property and the cost of operation. The gross revenue must equal the amount of the fixed charges, plus the cost of operation. The fixed charges are comprised of taxes, insurance, depreciation and interest or profits; the amount of these charges is fixed by the property values. The cost of operation must be determined from an examination of the accounts and records. The book figures should be carefully considered, from the standpoint of unit costs for operating and maintenance, to determine whether they are reasonable in amount to provide good service and properly maintain the property.

It is unusual in small telephone properties to find the accounts so kept as to show the true cost of the plant, under a proper classification; and it is often the case that there are no adequate plant records of any sort. The starting point of such a rate investigation is then the preparation of an inventory of the entire property and an appraisal of it, in most cases. Even where the book values are properly classified, there is always the problem of whether the book cost is the real cost, and even for no other purpose than a check, it is advisable to make the appraisal. But in most cases the appraisal is a necessity.

We shall start in the present instance with a property valuation assumed to have been made in this way, representing a typical plant of 500 stations, with open-wire distribution and grounded service. Such a plant would have two or three small exchanges, operating on a magneto basis, with the exchanges situated in small towns, and a considerable development of farmer or rural lines in the surrounding districts. The figures here given do not represent any actual plant so far as known, but have been prepared as typical of many systems of this size. Of course it is true that grounded service is defective and inferior, but many plants are still using it. The principles of rate making are the same whether we consider grounded or metallic service; and the additional cost of metallic service will be treated of later. The assumed property valuation appears in Table III.

TABLE III.

| | |
|---|---|
| Land | $ 900 |
| Buildings | 3,000 |
| Central Office Equipment | 1,500 |
| Distribution System | 2,000 |
| Telephones | 3,500 |
| Farmer Lines | 8,750 |
| Farmer Line Telephones | 3,750 |
| Furniture and Fixtures | 300 |
| Tools and Teams | 600 |
| Stores and Supplies | 500 |
| Total Physical Property | $24,800 |

REPRODUCTION VALUE OF PHYSICAL PROPERTY; 500-STATION; GROUNDED-LINE SYSTEM.

In addition to the reproduction value of the physical property, there are the following items to be allowed for: engineering; superintendence, contingencies and interest during construction; cost of organization and incorporation; necessary working cash capital.

Most of these plants had little engineering or superintendence during construction, and three per cent of the cost exclusive of land and stores and supplies is a fair allowance. For contingencies, five per cent is a fair allowance in plants of this character. The construction period, from commencement until operation begins, should not exceed two months and therefore one per cent is a fair allowance for interest. The actual cost of organization ought not to exceed $500; and $600 is a reasonable allowance for cash on hand, for operating expenses. These additions to the physical value appear in Table IV.

TABLE IV.

| | |
|---|---|
| Reproduction Physical Value | $24,800 |
| Allowance for Engineering, Superintendence, Contingencies and Interest During Construction | 2,100 |
| Cost of Organization | 500 |
| Working Cash Capital | 600 |
| Total Investment | $28,000 |

Table IV shows the fair amount of investment upon which the company should be permitted to earn a reasonable profit. It covers every source of legitimate and necessary expense up to the moment of commencing operation. The estimated value of the physical property should be checked by a comparison with the book cost, but as before stated, the book cost will not represent the real or actual cost unless the system of keeping the books and records has been a proper one. In order to show how an appraisal sometimes compares with the book figures, we shall assume that there is some difference. The balance sheet given below is made up of fictitious values, arranged to show the results of mismanagement in respect to keeping inaccurate records of construction costs. Of course the methods under which such properties have been promoted and financed are legion, and in some instances there has been gross overcapitalization. But this example has been prepared to illustrate a case of perfectly honest management, the emphasis being placed upon the lack of proper system.

TABLE V.

ASSETS.

| | |
|---|---|
| Plant Account | $18,137 |
| Real Estate and Buildings | 2,562 |
| Fixtures | 283 |
| Tools | 614 |
| Supplies | 428 |
| Accounts Receivable | 2,649 |
| Cash | 583 |
| Total assets | $26,256 |

LIABILITIES.

| | |
|---|---|
| Capital Stock | $ 8,000 |
| Bonds (six per cent) | 10,000 |
| Bills Payable (Notes) | 3,000 |
| Accounts Payable | 183 |
| Accrued Interest | 150 |
| Surplus | 4,923 |
| Total liabilities | $26,256 |

BALANCE SHEET, SHOWING FINANCIAL CONDITION OF PROPERTY ON DATE OF APPRAISAL.

The property account is equal to the total assets less accounts receivable and cash, or $23,024. This compares with $27,400 from Table IV. The fact that the book cost is too low may be explained in a number of ways. The most probable explanation is that some of the items that belong to construction have been charged to operation, thereby swelling expenses and diminishing the surplus earnings. This may happen through failing to charge up the time of the company's linemen and teams, when engaged on construction, or through the use of materials and supplies taken from operating stock and not transferred to the plant account, and it can happen in a variety of other small ways which amount in the aggregate to considerable sums. This serves to illustrate that the cost of construction can only be truly shown on the books by means of proper records and system. The book cost should be the real cost or else why keep it at all? The comparison of the estimated or appraised value and the book value shows that the difference of $4,376, or some substantially equal sum must have been charged to operation instead of construction, and had the accounts been kept properly, the property account would be substantially $27,400, and the surplus account would be greater by $4,376.

*(To be continued.)*

# ELECTRICAL Advertising and Selling

## THE VALUE OF SYNDICATE ADVERTISING TO THE CENTRAL STATION.[1]

BY CHAS. A. PARKER.

Syndicate advertising is the natural outgrowth of the modern tendency toward united and specialized endeavor. Its fundamental advantages to the central station lie in its peculiar adaptability to that institution's needs.

By far the greater number of central stations have their fields to themselves. They can insert syndicated illustrations with syndicated copy in the papers and send out syndicated mail matter with absolutely no reason to fear that it will be recognized as having been used by some one else in some other connection. This is a case where there is no chance for the familiarity that breeds contempt with the resultant effect of weakening your advertising.

As far as practical results are concerned, the central station obtains just about everything it could have obtained by doing the work itself, and it gets it with less effort and less expense. Experience has shown that the advertising needs of different central stations are practically identical. This does not mean that they must necessarily correspond in point of time as well as in kind; but it does mean that in the course of its history a central station will pass through periods identical with those other companies have experienced; that it can profitably and economically make use of syndicated matter that has solved the same problems successfully for some other concern.

Take for instance the question of winning popular favor. It is a fortunate lighting company indeed that never has to face a hostile public sentiment. If such there be let them congratulate themselves upon being members of a very small and select circle of favored ones. Most companies must work long and patiently to win friendship before patron and prospect will recognize them as anything but foes.

This is one of the many common needs that syndicated advertising has been very successful in meeting. The writer has in mind one service especially which consisted of a number of newspaper advertisements taking the form of personal talks from the manager. They assumed to take the public into the company's confidence, explaining the true nature of electrical service, how the current was produced, why it was impossible to create a great store of it and sell it like coal or flour. In the course of time the nature of the "peak" was explained and the necessity of keeping in perfect running order a much larger equipment than the average demand would seem to warrant made clear.

Newspaper advertising was supplemented by two mail services. One went to non-users, the other to users. The former sought to take advantage of any friendly feeling the newspaper service might have excited among non-users by offering very definite propositions on wiring the home, installing a few lights on trial, putting in electric utensils, etc.

The service to users, on the other hand, endeavored to clinch the matter that had been run in the papers. It aimed to induce a more extensive use of current. The whole scheme was rounded out by a few letters directed to employes of the company acquainting them with what the company was trying to do and urging them to put their shoulder to the wheel whenever they got a chance. By some very clever copy writing, an appeal was made to civic pride by the constant suggestion that electrical development was synonymous with the town's development.

This particular service was used extensively in all parts of the country and was almost invariably successful. Of course a few changes were necessary in each case, but the layout of the advertisements and mailing matter was such that this was in most cases a very simple matter.

Establishing the company in the good graces of the people from whom business must be expected is only one of the problems that central stations have in common and that can be solved by going to some advertising company making a specialty of syndicated electrical advertising.

Should the "power department" need a little special attention, subscribe to some power service that other companies have used and are using and the value of which has been demonstrated by more than one trial. So also with the house wiring, store and sign lighting, etc.

### POTENT REASONS FOR SYNDICATED ADVERTISING.

Of course it is not enough to say that because the work can be done by syndicated matter that therefore it should be done by syndicated advertising. There must be stronger reasons than these, as indeed there are. Not the least important is the fact that, except in the case of companies financially able to maintain large and well equipped advertising departments, there is no one with time enough (even if he happens to have the ability) to get out the advertising, newspaper and mail, take care of the detail work, write the copy, see to the plates and printing, add the little touch that gives advertising the ginger and go that enables it to win, and at the same time attend to his other duties.

The use of syndicated matter obviates the necessity for somebody taking all the work upon himself. The whole thing is done by an outside concern, which assumes the responsibility of seeing that everything is attended to, and that results are forthcoming. With some officer or executive of the company to put his O. K. on things as they go through, to keep track of results, to do any jacking-up that may be necessary, the central-station's end of the work is well taken care of.

Another strong advantage in favor of the use of syndicated advertising is to be found in the fact that the producer

[1] The eighth of the present series of articles on "Central-Station Advertising" appearing in the second issue of each month.

occupies the position of a person watching a game from the side. It is a fact too commonly commented on to need much attention here that an outsider is often better able to see the true status of affairs than some one actually engaged in the game.

While, of course, the advertising company which is producing syndicated matter is or should be thoroughly acquainted with the electrical business in all its ramifications, it still occupies the position to a large extent of an onlooker. It sees things not from the standpoint of the electrical company but from the standpoint of the patron, which, of course, is the proper standpoint to assume.

It seems to be an almost invariable rule that when some person in close touch with a business takes it upon himself to produce advertising, he immediately becomes lost in his own technical knowledge of the matter. He is apt to lose sight of the one little simple thing that is of real vital interest to his prospective patron and will spend his time and energy on matters which are of most vital interest to him. He is apt to talk in technical language, which may be and generally is nothing more than a veritable jargon to the untutored ears of the outsider.

This mistake is seldom made in syndicated-advertising matter, for the very simple reason that the man who produces it, not being technically acquainted with the subject, immediately — and even unconsciously—translates the trade terms into language familiar to himself.

He sees also the real point of contact at which he must meet the prospect and places an emphasis upon it that comes very naturally and is eminently proper.

BETTER ADVERTISING FOR LESS MONEY.

But all of these are minor points compared to the real reasons which give syndicated advertising its value and a substantial claim to the central-station's consideration. In short, syndicated advertising means that the central station is enabled to get the best possible advertising at the least possible cost.

The first cost of advertising matter is always the greatest cost—especially in the case of mail matter. Plates must be made, type set, and the advertisement composed before the first impressions are run. After that the cost per unit steadily decreases as the number of impressions run increases.

It requires no great exercise of reasoning power to see that a company producing such matter for a large list of companies will be able to sell it to each cheaper than the central station could produce it on its own behalf.

Instead of a multiplicity of plates and printings, to say nothing of advertising thought and detail work expended, the whole is concentrated in one place; plates, typesetting, composition and press work are reduced to the minimum.

One good advertising idea instead of serving only one concern is made to serve many, thereby cheapening its cost to all. Furthermore, while syndicated matter costs the central station less than it would to produce anything like the grade of matter itself, it is almost certain to be better than the central station could produce at any cost.

By better the writer does not mean more elaborate from a printing, engraving or lithographic standpoint, although this also is often the case where elaborateness is of value. By "better" he means that it has greater advertising value.

The advertising concern that is producing syndicated electrical advertising knows that its bread and butter depends upon its ability to bring in results for its patrons. It is also in a position where it can keep in constant touch with the advertising world in general. As a result it is no more than natural to expect it to be up-to-date in its own production.

NECESSITY OF HIGH-GRADE MATTER.

Syndicated advertising might be of less interest to the central station were it not so essential nowadays that advertising be of the highest possible quality. As the writer has suggested in other articles, people have been educated to it.

In a constant warfare to gain attention over all other advertising, advertisers have been pushing the standard of quality higher and higher until it almost seems as if the limit had been reached. Look, for instance, at some simple advertisement that was sent out ten or twelve years ago with the greatest success. Doesn't it compare with matter you see today about as favorably as an early "horseless carriage" does with a 1910 touring car?

If a concern were to try to keep its advertising up to present-day standards and do all the work itself, it would soon find its advertising appropriation becoming an intolerable burden. Thanks, however, to the companies making a specialty of syndicated electrical advertising, this is quite unnecessary.

If we add to the necessity for advertising matter of a higher quality an equally pressing necessity for a large volume of it, we have this part of our story completed. This need, like the other, finds its cause in the flood of advertising being sent out from every nook and corner of the country.

People's sensitiveness to advertising appeals has been so dulled that it becomes necessary to hit more often as well as harder in order to get their attention. Here again the central-station advertiser must recognize the value of syndicate advertising. It makes it possible for him to do this very desirable thing without too great a drain upon his resources.

The greatest advantage of syndicate advertising, however, is probably to be found in the fact that it has for the most part been tried and not found wanting. Except in a very small degree, the central station is not called to experiment. It would very naturally not be to the advertising company's interest to keep ineffective matter in circulating among its central-station patrons. Its logical policy would be one of elimination, the dropping of advertising ideas that had proved to be ineffective.

Experience shows that this has been the case and that it is only occasionally that a central station receives matter of uncertain advertising value or the effectiveness of which has not yet been demonstrated. In putting out its own advertising, the central station, unless it has a high-priced professional advertising man on its own staff, is very apt to make the great mistake of all inexperienced advertisers.

The individual charged with producing the matter will almost invariably seek to please himself, to get out that which satisfies himself rather than something which will get to the people he is after.

The sum and substance of all that has been said thus far would seem to suggest that no central station can make a mistake by subscribing to some good syndicated electrical advertising service. And indeed, this is pretty much the case, provided the central sta-

tion advertiser does not allow himself to be carried away by the too rosy promises of solicitors, but investigates carefully the company that is asking him to make a contract with it.

As in every other field, there are concerns seeking business which do nothing but collect a few unearned dollars and make it difficult for legitimate concerns to do business by shaking the confidence of the central-station managers in the whole proposition.

THE WEAK POINT OF SYNDICATE ADVERTISING.

But all this does not say that syndicated advertising does not have a weakness anywhere. It has, but it is a weakness that is never noticed when the central station itself shows a live interest in the work to be accomplished.

Syndicate advertising must, of course, be general in nature. It cannot aim directly at any peculiar local conditions that may happen to exist. And in so far as the central station does not by supplemental effort make up for the the deficiency, its advertising is weak.

This does not mean, however, that the central station after spending a sum of money with an advertising company must get busy and spend a lot more to get anything out of the first appropriation. It simply means that the central station must keep in close touch with the company that has its contracts, must inform it thoroughly of local conditions and co-operate with it in making the advertising matter fit in with its peculiar needs.

Syndicate matter is generally so arranged that without much additional expense, if any, it can easily be adapted to meet any circumstances that may arise. In addition to keeping in close touch with the advertising concern supplying it with matter, the central station must take care that its own forces are working in harmony with the advertising.

See that the solicitors realize perfectly their relation to the advertising. Too many of them are apt to be hostile. Too many look on advertising, especially if it be mail advertising, as detrimental to their interests, as something that may deprive them of their jobs. Let them understand that it is really going to make it easier for them to do business, that it is going to act as a sort of introduction for them, making approaches easier and enabling them to cover more ground.

The success of the whole thing, in short, rests not alone on the advertising but on the complete co-operation of all elements involved, advertising company, central-station management, solicitors and so on down the list.

A FEW SUCCESSFUL FORMS OF SYNDICATE ADVERTISING.

Of course it would be quite impossible to go through all the forms of syndicate advertising that have proven successful in the past, but there are certain types which may be mentioned as having won a permanent place for themselves by their effectiveness.

Possibly the foremost among these is the monthly magazine. This, in its best and most effective form, is a small publication the pages of which are devoted to syndicated matter, and the cover and back pages of which are purely local. The central station adopts its own name, which may easily be made so local in flavor as to disarm the "wise ones" who are aware of the fact that there is such a thing as syndicated advertising matter. Then on the back pages space is left for advertisements purely local in nature, if this is deemed expedient. Arrangements can also be made, as a general rule, to have certain space saved on the inside for local material to be supplied by the central station.

Many central stations have taken advantage of this to strengthen their position by using this space to "boost the town" or to arouse the civic pride of their citizens to a point where they will prefer to patronize local industries.

One of the latest and most effective forms that syndicate advertising has taken has been a calendar service. A neat little calendar (any one of which would probably cost the central station as much as the entire service should it endeavor to put it out itself) is sent out each month accompanied by a very attractive advertisement that is made almost entirely local in nature. This is now being used all over the country by a large number of companies, practically all of whom are ready to testify to its effectiveness.

For newspapers, an electric service is provided. The central station is furnished a blank on which it indicates its desires regarding the number of times a week or month it desires advertisements and the kind wanted. Then in due time cuts are submitted. If none are suitable, the central station may call for another choice, and the agreement even contemplates making new designs when a suitable one cannot be supplied.

The advertising company has no particular objection to this, provided these demands do not come in too frequently, as it proves an acceptable means of adding to their supply and hence to their ability to serve their patrons.

In addition to these there are specialized services of all sorts for power, sign, store and residence—in fact, for almost every conceivable need.

Syndicate advertising, in short, is no longer to be looked upon as a cheap, makeshift substitute for the real thing, but rather as the logical and economical method for the majority of central stations.

### Co-operative Advertising.

An excellent example of co-operative advertising in the electrical industry may be found in Cleveland O., where the *Cleveland News* publishes each week an electrical page, entitled "The People's Electrical Page," devoted entirely to electricity.

The reading matter on this page is of an interesting and educational character. The various uses of electricity are pointed out and miscellaneous items pertaining to electricity are published.

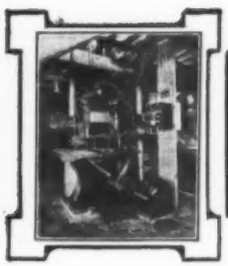
The electrical industry of Cleveland is well represented in the advertising columns and as a whole this page marks a great step toward the popularizing of electricity.

### Boosting Chicago.

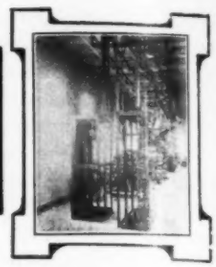
The Metropolitan West Side Elevated Railway Company, Chicago, Ill., is calling the attention of manufacturers in all parts of the state, by means of letters and maps, to the West Side of the city of Chicago as an ideal location for any kind of industry, whether large or small, pointing out that this section of the city presents to the manufacturer all the essential elements necessary for successful operation and future growth.

### Toronto Company Issues Attractive Booklets.

Two attractive little booklets have been distributed recently, by the Toronto Electric Light Company, Ltd., Toronto, Canada, one dealing with electric illumination and one with electric power. Both are profusely illustrated and the text presents forcible arguments in favor of the use of electricity.



# Industrial Power



## MODERN ELECTRIC TIME SERVICE.[1]—III.

BY F. HOPE-JONES.

The time transmitter of Leicester, is very similar and is illustrated in Fig. 8. The gravity lever $N$ is at the bottom with adjustable weight $N_1$ and the magnet above. The impulse surface $R_1$ is near the center of the pendulum $A$, and the impulse roller $P$ is seen just above it. The pendent armature does not itself make contact, but ends at $V$ in a trip lever which pushes lever $T$ carrying contact surface $S_1$ forward enough to rest the lever $N$ and then allows lever $T$ to fall back. I understand, however, that this was not found beneficial and that they have since adopted the pure momentum break of the "Synchronome" system. The propulsion of the wheel is not shown, but is carries pins $J$, $J_1$ which, at the completion of revolution, raises the projection $K$ on cranked lever $F$, centered at $H$, thereby allowing the lever $G$ to ride at a lower level and disengage the hook $M$ from the catch $O$.

The dial movement of the Gent system is similar to that illustrated in Fig. 7 in its earlier form; in fact, most unidirectional current systems have now adopted the electromagnetic time counter described in the 1899 paper.

From the first inception of the "Synchronome" system in 1895, the dominant idea was to design these dial movements for quick action and the switch for slow action, giving the latter both mechanical and electrical inertia. The dials are made to work with less current and with a contact of shorter duration than is required to operate the switch, but it was obviously desirable to measure the extent to which the current rate and the duration of the contact exceeded in ordinary practice that required by the dials. And it is well to demonstrate in a convincing manner how short is the duration of impluse necessary, because nothing less than a whole second was previously used, and most systems of electric clocks on the Continent and in the United States of America still have impulses whose duration is from fifty to one hundred times longer than necessary.

Thanks to Mr. Duddell's oscillograph,

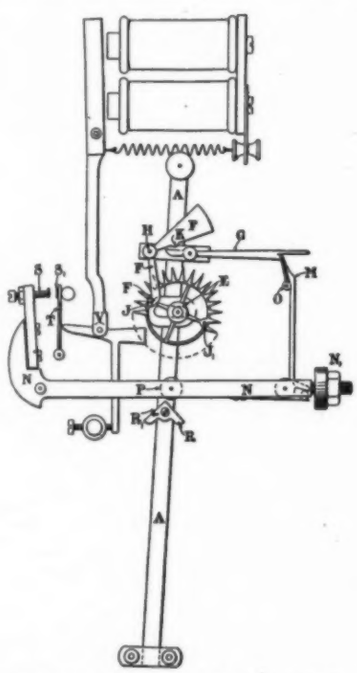


FIG. 8.—LEICESTER'S TRANSMITTER.

I have now been able to investigate the precise nature of the impulses transmitted by the "Synchronome" switch and exactly what happens in circuits of electrical impulse dials of varying number and size. The precision of the make and break has been demonstrated and compared with the intermitted nature of the mechanical or relay contacts previously used for such purposes. It has also been possible to determine precisely the most efficient arrangement of electric time circuits with regard to duration of impulses and voltage, and to lay down rules whereby full advantage is taken of the compensatory effects of increased duration of impulses consequent upon decline of battery.

For the purpose of this investigation a "Synchronome" time transmitter of the type illustrated in Fig. 6 was used in series with various sizes and numbers of dial movements as illustrated in Fig. 7. An oscillograph was included in the series circuit so adjusted that a deflection of forty millimeters was produced by a current of one ampere. The wave-forms were recorded on partially counterbalanced falling photographic plates arranged so that the mean speed of the plates was 100 centimeters per second. The plates were supported on a catch at the top of a light-tight slide and fell into a red cloth bag at the bottom. The catch was withdrawn by an electromagnet controlled by a contact on the pendulum set to operate about a second before the observation, the exact time being readily adjusted to allow for such variations as differences of weight of the photographic plates.

Brief mention should be made of two more systems which have appeared since 1905—Bowell's and Murday's. The vibrations of the pendulums of the master clocks in each of these systems are maintained by the Foucault-Hipp electric "Butterfly" escapement illustrated in Fig. 9. The little trailer $A$ pivoted freely on the pendulum $P$ swings clear of the notch in the block $B$ until the arc falls to a certain predetermined minimum, when it jams in the notch and presses the two counterbalanced levers together, making a reliable contact and causing the magnet below the pendulum bob to restore the arc.

In both systems a count-wheel is used to select the semivibration at each half-minute when contact shall be made for the operation of the dials.

In G. B. Bowell's system (made by the Silent Electric Clock Company) the pendulum charges into contact springs at the end of its swing, making a com-

1 Abstract of a paper recently presented before the Institution of Electrical Engineers, London, Eng.

paratively long contact to operate dial movements with rotary armatures in a permanent magnetic field.

In T. J. Murday's system (made by the Reason Manufacturing Company, Ltd.), the contact is a passing one made at zero, and the dial movements have reciprocating armatures pivoted between the poles.

For twenty-five years Mr. Murday has been the principal exponent of the Hipp Butterfly escapement in this country, and had many useful and original applications of it. In 1901, with the Standard Time Company, Ltd., he applied it to the heavy pendulums of turret clocks with perfect success and inaugurated a method of turret clock

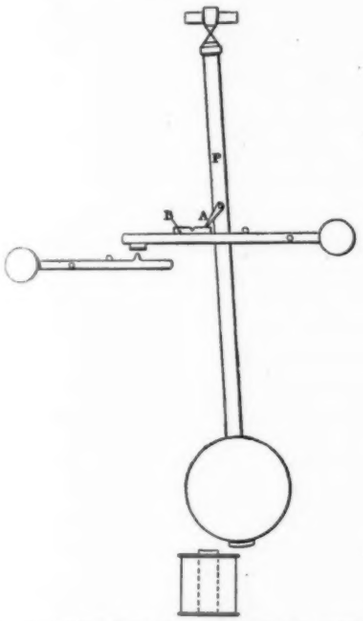



FIG. 9.—FOUCAULT-HIPP ELECTRIC "BUTTERFLY" ESCAPEMENT.

driving which has a great future before it.

Looked upon simply as a method of conversion of electrical energy, this is probably the most efficient motor ever designed, and it must be remembered that, unlike ordinary motors, it is at its greatest efficiency when working at its slowest speed, rotating its driving wheel at the rate of, say, one revolution per minute. There is no theoretical limit to the amount of power which may be developed by this means, and it increases the frequency of its impulses automatically in exact proportion to their lack of strength and in proportion to the work demanded of it.

By the addition of a third contact lever below the other two the Standard Time Company provides an alternative source of electrical energy which comes into operation if the first one fails. Gents, of Leicester, have recently introduced a simple means of bringing a Hipp-driven clock under the control of a half-minute time circuit, similar in principle to that used by the Standard Time Company for synchronizing it. It is illustrated in Fig 10. In vibrating, the pendulum pulls round the wheel *E* by means of the hook-shaped pawl *A*. The length of the pendulum or the number of teeth on the wheel *E* are so arranged that the hands of the clock are advanced half a minute in about twenty-seven seconds by means of this gathering pallet *A*. A pin *F* in the wheel *E* then lifts the control lever *C* and disconnects the pawl *A* by lifting it out of the wheel *E* and allowing the pendulum to oscillate idly. When the half-minute time-circuit impulse energizes magnet $D_1$ the arm $C_1$ of lever *C* is released and the pendulum again drives the hands as before.

There may be some limit as to the size of a turret clock which can be dealt with by this method, and I offer a constantly running motor controlled by a "chaser" switch as being suitable for the "Big Bens" of the future.

A motor with a double-worm reduction gear, reducing the speed from, say, 1,800 revolutions per minute to one revolution in five and one-half minutes, carries a disk rheostat on its slow-moving axle. A switch arm mounted freely on this axle is driven by an electrical impulse dial movement in a standard time-circuit of half-minute periodicity on to the contact studs, cutting out resistance in the motor or armature field. These resistances are so proportioned that the motor is constantly running at a speed dictated by the half-minute progression of the chaser switch.

Existing turret clocks may be relieved of their dangerous and cumbersome driving weights and the necessity of winding them (which often has to be done daily) by means of small rotary motors. The Huyghens endless chain is admirably adapted for the purpose of connecting a motor to the "going" train of any ordinary turret clock. All that is wanted is bicycle gear-wheels and chain supporting a small weight which switches the motor in at the bottom of its fall and out at the top. Bell hammers may be directly driven without the intermediary of any remontoire.

It is satisfactory to note a recent tendency to more enlightened inventive work in this field—really progressive improvements based upon such of the work of other inventors as has been proved to be sound.

The experience of the last ten years has shown that the principles then formulated before this Institution are necessary to the success of any system of electrical impulse dials with simple movements for operation by unidirectional currents. The most important of those principles were the transmission of energy through the surfaces of the contact and taking it from the electromagnet instead of from the clock or its pendulum; the immense economy of current and the certainty of its sufficiency obtained by short duration contacts dictated by the self-induction of the whole system; and the momentum stop in the dial movement.

Since then the application of Sir Henry Cunynghame's free detached gravity arm and the extended range of battery warning given by the pendu-

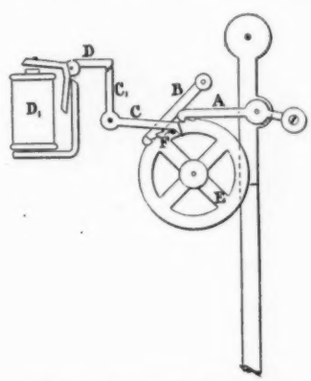



FIG. 10.—CONTROL DEVICE.

lum's assistance to the magnet in resetting the switch have given a great impetus to electric time service.

Circuits of electrical impulse dials will always take the premier position as the most generally useful application of electricity to horology because that method is the most simple and direct means of attaining absolute uniform time with a high degree of accuracy. Now that we have succeeded after so long a fight in breaking down the prejudice aroused by the failures of so many systems, let me urge manufacturers and contractors not to kill the goose that laid the golden egg by cutting prices and by putting in electric-bell wiring.

I have always claimed for electric

time service a position as a reputable branch of our profession, and I can do so with more confidence now, thanks to the enterprise of other firms who have taken up the business of electric clocks and the healthy competition which has resulted.

### Cambric Pinions.

A brief description and history of this invention may be of interest, says the *General Electric Review*.

A large punch and shear, driven by a motor through a train of gears and installed in a blacksmith shop, where the work is very heavy and rough, had been giving a great deal of trouble, both from noisy gears and from stripping of the gear teeth.

As originally fitted up, the train of driving gears consisted of a brass pinion on the motor shaft which drove through a cast iron cut gear on a countershaft, and this, in turn, through another pinion connecting with the main gear of the machine. The countershaft carried a heavy flywheel, which, when running, caused a backlash that several times stripped the teeth from the cast iron gear. The brass gear also soon lost its shape and gave trouble. After this experience a street-railway gear and pinion were used, but they made an intolerable noise and had to be discontinued. It was at this stage that the inventor, looking for a substitute which would stand up, and having in mind rawhide and fiber, bethought him of having a muslin pinion made. This pinion was accordingly made, and was put on the punch over a year and a half ago; up to the present writing, it has not given a particle of trouble, neither does it show any appreciable signs of wear.

Since that experience, a great many other troublesome machines have been similarly equipped, until at present there are 700 of these cambric pinions in active service, and as yet not one has failed.

In making these pinions, the following process is followed. The muslin is cut out in disks which are assembled and pressed between two steel washers, the whole then being securely fastened with rivets or tap bolts, following the same method as that of making rawhide pinions. The blank is next turned to the proper diameter and the teeth cut in a gear cutter. The gear is then soaked in a good quality of machine oil.

These pinions can be made in various forms, of any reasonable size, and either with or without metallic centers. It is absolutely necessary, however, for the shrouding to extend to the full diameter of the gear.

With these pinions, the use of lubricants is unnecessary, as the oil which was absorbed by the muslin in the oil bath will keep the teeth of the pinion lubricated for an indefinite length of time. In the actual running of these gears they seem to take a metallic coating on the teeth, which tends to protect them from excessive wear from the teeth of the other gear.

In addition to these features, there is also a certain amount of flexibility which is beneficial, as in all commercial gears there is apt to be some slight inaccuracy in the spacing from tooth to tooth. When such gears are run with other metallic pinions there may be, and frequently is, an excessive strain brought on one tooth, which tends either to bend or break it. With the cloth pinion, however, the flexibility afforded by the material tends to distribute the strain over at least two or more teeth, depending on the size and number of teeth in contact; these will stand any reasonable amount of this bending, there being no fibers to crystalize as in the case of the metallic gears.

Some engineers, when the matter was first brought to their attention, were inclined to be a little skeptical, but the pinions have given and are giving a practical demonstration of their merits by running every day in the hardest kind of service. An inspection of some of these cases would satisfy anyone as to their worth.

### Electrically-Operated Fertilizer Plant.

A recent dispatch from Montgomery, Ala., states that F. S. Royster Guano Company, of Norfolk, Va., will probably soon begin the erection at Montgomery of an electrically-driven fertilizer plant to cost about $100,000. The company already operates plants at Norfolk, Baltimore and other towns in the South.

### A Large Electric Mine Hoist.

What is said to be the largest second-motion electric hoist in the world was recently erected and successfully put into operation at the Butte-Ballaklava mine at Butte, Mont. This hoist will operate to a maximum depth of 3,000 feet.

### Longevity of Tungsten Lamps.

In the London *Electrical Times* of April 14 is given an account of some extraordinary long-life performance of tungsten lamps. While it is known that in many instances tungsten lamps have exceeded their rated life by over fifty per cent, the English publication states that it is quite common for them to have a life of over 3,000 hours, and several instances are known of them having achieved from 5,000 to 10,000 hours. One case in particular is cited of a 100-candlepower Osram lamp that burned continuously for 15,643 hours, with only a moderate diminution of candlepower till the end. Whether this lamp was burned at normal voltage or below this it would be interesting to know positively. However, if such a long life, or even one one-third as long, became common and could be maintained at close to rated efficiency, the tungsten lamp would quickly sweep all competitors from the field and hold practically undisputed sway.

### Dimensions of Kathode Emissions in Vacuum Tubes.

In a paper read on May 17 before the Academy of Sciences, Paris, France, M. Houllerigue describes a research made to determine the dimensions of the material particles projected by the kathodes in vacuum tubes. In the experiment, the projected metal (silver) is deposited on a glass plate and the minimum thickness determined at which the layer becomes electrically conductive. The point of conductivity is reached suddenly and corresponds to a certain thickness of the metallic layer. The diameter of the particles, calculated from the data recorded from the investigation, is of the order of twenty-two to twenty-six $\mu\mu$.

### Storage Batteries for Car Lighting.

The Western Ohio Electric Railway, according to a report from Columbus, Ohio, will provide balance storage batteries to keep uniform the electric lighting on the ten new cars soon to be installed on its limited service.

### An Electric Thermophile.

In a paper read on May 17 before the Academy of Sciences, Paris, France, M. Herrgott describes an electric thermophile, comprising a woven material containing fine nickel wire and heated electrically.

## FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

KANSAS CITY RAILWAY AND LIGHT.

The report of the Kansas City Railway and Light Company for the month of April and eleven months ended April 30, compares as follows:

| | 1910 | 1909 |
|---|---|---|
| April gross | $ 601,476 | $ 552,628 |
| Expenses | 407,208 | 308,610 |
| April net | 194,268 | 244,018 |
| Charges and taxes | 158,790 | 156,271 |
| April surplus | 35,478 | 87,747 |
| Eleven months gross | 6,363,190 | 6,052,696 |
| Expenses | 3,761,675 | 3,438,829 |
| Eleven months net | 2,801,515 | 2,613,866 |
| Charges and taxes | 1,734,969 | 1,728,347 |
| Eleven months surplus | 1,066,545 | 885,518 |

LONDON UNDERGROUND.

The associated companies of the Underground Electric Railways Company of London report for the month of April, 1910, which compares as follows:

| | 1910 | 1909 |
|---|---|---|
| Metropolitan District Railway: | | |
| Gross receipts | £ 57,095 | £ 49,389 |
| Working expenses | 26,538 | 26,305 |
| Net receipts | 30,557 | 23,084 |
| Baker Street & Waterloo Railway: | | |
| Gross receipts | 15,853 | 14,793 |
| Working expenses | 7,367 | 7,455 |
| Net receipts | 8,486 | 7,338 |
| Great Northern, Piccadilly & Brompton Railway: | | |
| Gross receipts | 27,923 | 25,434 |
| Working expenses | 14,635 | 14,841 |
| Net receipts | 13,288 | 10,593 |
| Charing Cross, Euston & Hampstead Railway: | | |
| Gross receipts | 17,312 | 17,655 |
| Working expenses | 10,002 | 10,284 |
| Net receipts | 7,310 | 7,371 |
| London United Tramways, Ltd.: | | |
| Gross receipts | 25,236 | 27,549 |
| Working expenses | 19,929 | 17,267 |
| Net receipts | 5,307 | 10,282 |
| Total all companies: | | |
| Gross receipts | 143,419 | 134,820 |
| Working expenses | 78,471 | 76,152 |
| Net receipts | 64,948 | 58,668 |

HAVANA ELECTRIC COMPANY.

At the annual meeting of the Havana Electric Company, held in Jersey City, N. J., the following report for the year ended December 31, 1909, was presented: Gross earnings of railway, $2,106,761; operating expenses of railway, $955,237; net earnings of railway, $1,151,524; gross earnings of stages, $381,886; operating expenses of stages, $295,812; net earnings of stages, $86,074; total net earnings, $1,237,598; fixed charges and taxes, $443,984; balance, $793,614; collected during the year on suspense account, etc., $22,717; surplus earnings available for dividends, $816,331; dividends, $523,911; balance to profit and loss, $292,420. The balance sheet of the Havana Electric Company, as of December 31 last, shows cash on hand and balance in bank amounting to $557,792, stock of material and fuel on hand $400,783, and a profit and loss surplus of $1,024,465.

The report states that during the year the amount of maintenance work done was more than twice as great as in previous years, fifteen pieces of imported special work having been done and some 410 rails replaced with new material. Paving repairs were also especially heavy, 80,655 square metres having been done. Passenger traffic during the year showed a considerable increase, partly due to the increase in population, but the greater part was attributable to the constantly improving car service.

GENERAL ELECTRIC.

The General Electric Company, incorporated under the laws of New York, has filed with the Massachusetts secretary of state a statement of its financial condition as of April 1, 1910, which compares as follows:

ASSETS.

| | 1910 | 1909 |
|---|---|---|
| Real estate | $ 3,244,609 | $ 35,124 |
| Machinery | 7,422,806 | 13,985,978 |
| Merchandise | 27,661,287 | 20,341,659 |
| Cash and debts received | 33,580,808 | 39,229,981 |
| Patent rights | 1 | 1 |
| Miscellaneous | 25,949,207 | 25,469,759 |
| Total | 97,858,719 | 99,112,505 |

LIABILITIES.

| | | |
|---|---|---|
| Capital stock | $65,179,600 | $65,178,800 |
| Accounts payable | 3,403,380 | 2,997,792 |
| Funded debt | 14,962,000 | 14,963,100 |
| Profit and loss | 14,313,739 | 15,972,912 |
| Total | 97,858,719 | 99,112,505 |

MONTREAL LIGHT, HEAT AND POWER.

The Montreal Light, Heat and Power Company has issued its report for the year ended April 30, 1910. The income account compares as follows:

| | 1910 | 1909 |
|---|---|---|
| Gross | $4,240,945 | $4,079,769 |
| Expenses | 1,848,878 | 1,844,653 |
| Net | 2,392,067 | 2,235,116 |
| Interest | 480,866 | 489,268 |
| Surplus | †1,911,200 | 1,745,848 |
| Dividends | 1,190,000 | 1,020,000 |
| Surplus | 721,200 | 725,848 |
| *Deductions | 400,000 | 418,380 |
| Surplus | 321,200 | 307,468 |

*Deductions for depreciation and insurance funds.

†Equal ot 11.24 per cent on $17,000,000 capital stock as compared with 10.27 per cent earned on same stock last year.

### American Street and Interurban Railway Association.

Preliminary announcement has been made of the 1910 convention of the American Street and Interurban Railway Association, which is to be held at Atlantic City, October 10-14.

Although several cities have put their convention facilities at the disposal of the Association, the Committee on Convention Location selected Atlantic City as the most suitable meeting place.

Announcement will be made of exhibits, programme and other features at a later time.

### Copper Exports.

Exports of copper for the week ended May 26 were 7,545 tons Since May 1 they were 19,666 tons compared with 27,775 tons the same period last year

### Electrical Exports for April.

The Bureau of Statistics of the Department of Commerce and Labor, Washington, D. C., has issued its summary of imports and exports of the United States for the month of April. From this the following facts relative to the electrical exports from this country for that month are taken.

A marked increase occurred in the exports of electrical appliances, including telephone, telegraph and other instruments, the total for last April being the greatest monthly total ever reached in that line and nearly twice the total for April last year. On the other hand the exports of electrical machinery for last April fell back nearly to the average value prevalent for many months, so that the encouraging increase shown in the machinery figures for March was not maintained.

That these figures are typical of the general trend of the electrical exports is shown by the totals for the ten months ending with April 30 in each case for the past three years, as follows:

| | Electrical Appliances | Electrical Machinery | Total Electrical |
|---|---|---|---|
| 1907-8 | $5,868,371 | $7,366,634 | $13,235,005 |
| 1908-9 | 4,940,397 | 5,302,122 | 10,242,519 |
| 1909-10 | 6,765,990 | 4,777,123 | 11,543,113 |

The comparative monthly data are as follows:

| | April 1910 | April 1909 | March 1910 |
|---|---|---|---|
| Electrical— | | | |
| Appliances | $ 959,186 | $490,483 | $ 783,371 |
| Machinery | 484,658 | 489,026 | 699,261 |
| Total | $1,443,844 | $979,509 | $1,842,632 |

The principal countries to which electrical products were sent last April, together with the values of these exports, are as follows:

| Exported to— | —Electrical— Appliances | Machinery |
|---|---|---|
| United Kingdom | $ 76,764 | $ 26,817 |
| Belgium | 6,353 | |
| France | 3,145 | 22,552 |
| Germany | 3,172 | 14,442 |
| Other European countries | 8,050 | 39,793 |
| British North America | 227,289 | 99,581 |
| Central American States and British Honduras | 33,148 | 11,321 |
| Mexico | 128,197 | 73,877 |
| Cuba | 30,664 | 10,665 |
| Other West Indies and Bermuda | 5,333 | 684 |
| Argentina | 98,548 | 21,326 |
| Brazil | 226,040 | 44,665 |
| Other South American countries | 32,627 | 31,627 |
| British East Indies | | 16,480 |
| Japan | 50,731 | 33,791 |
| British Austral Asia | 7,543 | 4,440 |
| Philippine Islands | 11,349 | 111 |
| British Africa | 3,242 | 5,506 |

### Seventh Avenue Subway

A subway running under Seventh Avenue from Times Square to the Battery will soon come under the consideration of the Public Service Commission of New York City. At the present time the engineers and legal department of the Commission are at work on three plans for the construction of this road.

# New Electrical and Mechanical Apparatus and Appliances.

### Hughes Electric Cook Stove.

As the electric lighting industry has progressed the thoughtful central-station manager has been making a closer study of the load diagram. This scrutiny has revealed that too much attention cannot be paid to the introduction of devices on lighting and power circuits that fill up, so to say, the low level in the diagram. There was a time, and not so long ago either, that not a few central-station men laughed at the possibilities advanced by the enthusiastic advocates of the electric heating devices. The increasing study of the various applications of electric heat

HUGHES ELECTRIC COOK STOVE.

throughout the home and the arts has led, however, to the production of many valuable electric devices.

The day when the electric flatiron was, practically speaking, the only heating device on the market has passed. And a careful survey of the heating apparatus exhibited at the National Electric Light Association's convention at St. Louis revealed an upward trend of this part of the business.

A device exhibited at this convention that won admiration on account of its eminent practicability was the Hughes electric cook stove. Incidentally it may be said that this device is not an experiment, nor a novelty, in so far as development is concerned. The designers of the Hughes stove realize that the time has come when the public demand not a stove that would merely toast and do such things as a chafing dish is used for, but that the housewife now requires, a universal cooker, giving an abundance of steady heat for all kinds of cooking, baking and other work just as is required of the ordinary kitchen stove. This stove is strongly made for hard usage, having steel body and legs, finished in hard-baked black japan and tastily decorated, easy to keep clean and takes up very little space. It stands in any position and can be moved at will. It insures a maximum of solid comfort, exceptional convenience and real service. It costs no more than an ordinary gas or gasoline stove, and works equally well on either direct or alternating current. It is made for all commercial voltages up to 220 volts. The heat may be instantly controlled by the operator. One can have a small fire or a large one at will, or both at the same time if desired. The stove is so constructed that by the use of a three-heat switch three degrees of heat for each burner may be obtained.

The current consumption for the first heat is 150 watts; for the second heat 300 watts, and for the third heat 600 watts.

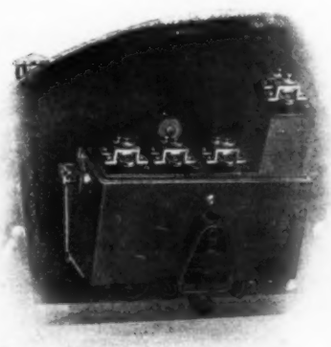
The Hughes stove is made in three sizes, equipped with one, two or three burners as desired. If desired a steel oven heavily enameled and large enough for baking bread and all kinds of roasting can be furnished. There are no burners to clean and no dirt to hinder the flow of heat. The burner, it is claimed, produces quicker results with less consumption of current than any other, due to the method of construction. An absolute guarantee is given to renew the heating element if it burns out within one year.

A point relative to manufacture that will be of decided interest to the central-station man relates to the heating element proper. The base of the heating element is eight and one-half inches in diameter and is made of a special composition of the company's manufacture. The wire is a patented alloy and is practically non-oxidizable.

This electric stove is manufactured and was exhibited at the St. Louis Electric Light Convention by the Hughes Electric Heating Company, 315 Dearborn Street, Chicago, Ill.

### New Connecticut Hinge-Bracket Spark Coil.

The Connecticut Telephone and Electric Company, of Meriden, Conn., has placed on the market a new type of hinge-bracket spark coil. This is especially designed for cramped dashes of automobiles where it is, in many cases, impossible to remove the units of the coil without taking the coil off the dash. With this hinge bracket it is possible to swing the coil back from the dash in such a position that the units can easily be removed, thus taking advantage of one of the most important



HINGE-BRACKET SPARK COIL.

points in the construction of Connecticut coils, as all these coil units are interchangeable without touching a wire connection.

### Engineering Apprentices.

An innovation in the training of engineering students and apprentices, such as are taking courses in the various local works, was brought about recently, when 100 young men from the shops of the Allis-Chalmers Company, at West Allis, Wis., were taken over the route of the Milwaukee Northern Railroad, shown the large gas engine power plant in operation and given an opportunity of inspecting all of the electrical equipment, including that contained in the substations.

### A New Electrical Resistance Alloy.

The Electrical Alloy Company, Morristown, N. J., is placing on the market a new electrical resistance alloy, named "Nico," which is said to be especially valuable for use in controllers, heating apparatus, arc lamps, telephone coils, and all other apparatus where a non-corrosive material, having a very high resistance, is required.

Nico contains no iron and is specifically recommended for use in resistances exposed to abnormal atmospheric conditions or moisture. Also for use in rheostats where the amperage is high and the rheostat is subjected to severe conditions of overloads and give superlative results where it is important that the operating temperature shall be kept at a minimum degree of heat when the apparatus is under heavy strain.

Nico is furnished in every variety of wire and is sold with the following claims: High, permanent resistance, low temperature co-efficient, non-oxidizable, non-corrosive and indestructible.

### Edison Batteries for Electric Vehicles.

The Ohio Electric Car Company, builder of the Ohio electric vehicles, has contracted for a large number of Edison batteries, which in the future will be listed as regular equipment on its cars.

### Ridgway Dynamos.

Following the successful completion of its first alternating-current generator, the Ridgway Dynamo and Engine Company, Ridgway, Pa., has developed and placed on the market an extensive line of such machinery. These alternators are all of the revolving field type and embody many features of interest.

The armature core is built from punchings of high-grade, thin transformer steel, selected on account of its low hysteresis and good magnetic qualities. Before being stacked the punchings are machine coated with insulating varnish for the purpose of reducing eddy-current losses. Several air ducts are provided in the core for ventilation purposes.

The armature frame consists of two heavy cast-iron rings having an I-beam section. The core is clamped securely in position between these rings by bolts which pass through the core but outside of the magnetic circuit. This method of construction, illustrated in one of the accompanying illustrations, has several advantages, the most important of which is the good ventilation of the core which is secured.

The armature winding is of two types, depending upon the voltage for which the machine is designed. For 1,100 volts and over the winding is of formed coils, impregnated with insulating varnish, and baked into a solid mass. All such coils are wound on a single form and are, therefore, interchangeable. For lower voltages the winding consists of solid copper bars, carefully insulated with tape and varnish, and baked before being placed in the slots. Before the winding, whether of bars or of formed coils, is placed in the core, the slots are lined with heavy insulating material, the di-electric strength of which is many times greater than necessary, and which will not deteriorate when subjected to much higher temperatures than those resulting from actual service under heavy overloads. The armature construction is the same for both belted and engine type generators.

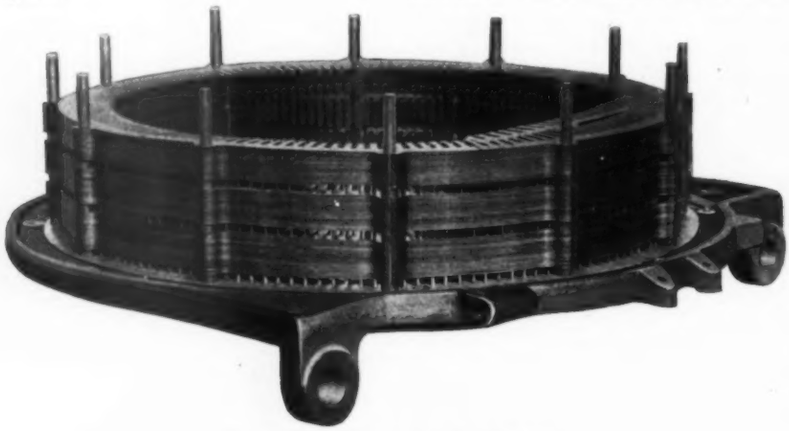
COMPLETE ARMATURE.

ENGINE-TYPE FIELD ASSEMBLED.

The field spider of small engine-type generators is a single steel casting. In larger machines it is of cast iron, onto which is shrunk a heavy rim of cast steel. The pole pieces are built up of laminated steel punchings, held between heavy brass end pieces and are bolted to the spider by stud bolts which screw into the poles and pass through the rim of the spider.

The field of a belted machine differs materially from the above. Here the spider consists of a laminated steel core mounted on a heavy cast-iron hub and clamped between substantial end plates. In the periphery of this core are

punched T-shaped slots corresponding to similarly shaped projections on the laminated pole pieces. A small space is allowed between the projections on the pole pieces and two sides of the slots, and into these spaces are driven square keys which hold the pole pieces securely in place.



ARMATURE CORE BEING STACKED.

The construction of both types of field is such that the pole pieces and field coils may be quickly removed, and at the same time the spider is strong enough to resist the heaviest strains which can be imposed upon it.

ARMATURE CORE COMPLETED.

The field coils of small-engine and belted-type machines are wound from square copper wire, having rounded edges, and insulated with a double layer of cotton. On larger machines of both types the coils consist of copper strip wound on edge, and insulated with paper and insulating varnish. In assembling the field, the coils are well insulated from the adjacent metal by fiber and oiled muslin. At one side of each coil there is placed a thin metal blade which, when the armature is in motion, produces a strong current of air past the coil and across the face of the armature core. In addition to this fan, there is, in belted generators, a ventilating duct passing through the middle of the coil.

The collector rings for conducting the exciting current to the field coils are of cast iron mounted on a separate spider and well insulated therefrom. The brush holders are of the box type, each carrying two carbon brushes, and are usually mounted on the adjacent bearing.

These alternators are wound for single-phase, two-phase and three-phase circuits, for either twenty-five or sixty cycles per second and for the usual standard voltages.

**Additional Power in Pawtucket Plant.**

The Pawtucket Electric Company has arranged with the Stone & Webster Engineering Corporation for the enlargement of the South power station at Pawtucket, R. I.

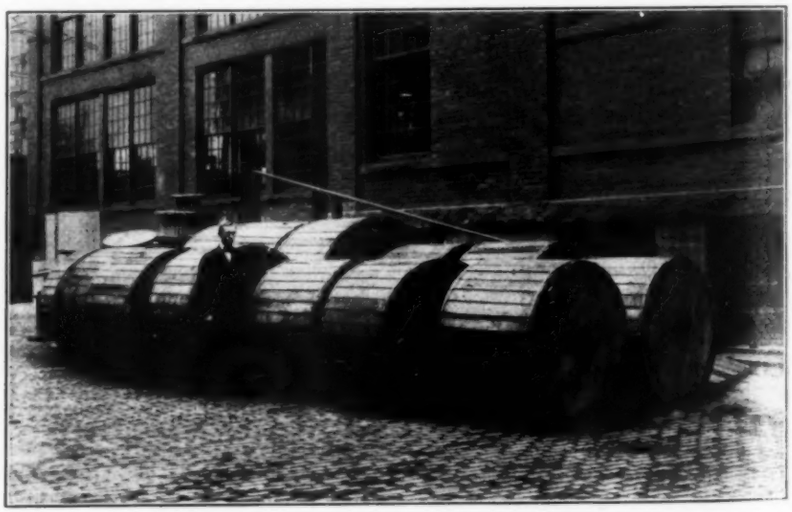
The engineering and construction contract calls for an additional 5,000-kilowatt turbine and two 520-horsepower boilers. All boilers will be equipped with mechanical stokers and forced draft apparatus. New coal-handling apparatus, consisting of overhead bunkers, horizontal conveyor, coal crusher and elevator will also be installed.

**Army Wire Furnished by Diamond Rubber Company.**

The Diamond Rubber Company, Akron, Ohio, has recently completed for the government an order comprising over six miles of Diamond lead-incased, multiple-conductor cable, which is used for fire-control service in the Signal Corps of the United States Army. Part of this order has been shipped to New York, part to California and part to Hawaiian territory.

In view of the fact that United States government specifications are most rigid, the acceptance of this order by the government would indicate that Diamond rubber-covered wires and cables meet specifications absolutely and in the words of one of the officials of the company, "Go just a little bit further."

The accompanying illustration shows a portion of this order ready for shipment.



SHIPMENT OF DIAMOND WIRE FOR GOVERNMENT.

### Small Motors.

The Engineering Electric Manufacturing Company, Stamford, Conn., is manufacturing and placing on the market a line of small motors and generators having many commendable features.

These motors range in size from one-twentieth horsepower to one horsepower and are especially recommended for electric pianos, telephone and telegraph use, phonographs, vacuum cleaners, washing machines and all light power purposes.

Regarding construction, the square frame has been adopted, as may be seen in Fig. 1. This form provides a convenient means for attaching gear shafts, brackets or other fixtures directly to the motor frame. The motor itself may be bolted or attached to special supports with the least amount of labor and expense for fitting and mounting. The motor is also compact and occupies the smallest cubical space for a given output and speed, with no dangerous crowding of windings and connections.

A distinctive feature of the design of this motor is the cradle for supporting the armature bearings and brush holder. This is shown clearly in Fig. 2. The cradle consists of a solid casting surrounding the armature carrying both bearings and the brush holders. One end of the cradle is enlarged for convenient and accurate attachment to the motor frame as shown.

Another feature of this type of motor is that both bearing sleeves are carried in one rigid casting, thus assuring perfect alinement. Another important advantage of this invention is that the cradle arms occupy the space between the pole tips and are so proportioned that their effect on the armature is to provide a perfectly neutral magnetic field on the line of commutation, thus greatly aiding in securing sparkless and perfect operation under the most extreme conditions of service. The cradle also carries the brush holders as shown. Each holder is positively secured to the cradle by two heavily insulated screws so that no looseness or displacement can occur under any conditions. Double brush holders are used in all but the smallest sizes and the design of the holder is such that the wear on the brush is uniform throughout its entire range of feed. The cradle is secured to one side of the frame fitting in a machined seat, which is concentric with the armature and field bore. By simply removing four screws, the entire cradle with its armature, brush holders and bearings can be removed from the frame without disturbing the motor in any other way.

Practically all users of small motors in quantities demand a shaft suited to their special conditions. For this reason, it is not at all uncommon to find that fifty or more sizes of shafts are required on one size of motor. It is impossible to carry an extended stock of armatures having these various dimensions of shafts, hence such motors are built to order only. This results in a serious loss of time and extra expense, both to the manufacturer of the motors and the customer. This difficulty is completely overcome in the type C motor.

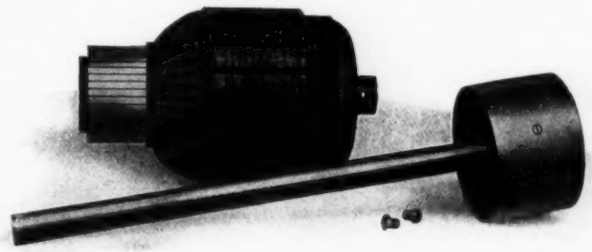


FIG. 3.—TYPE C ARMATURE SHOWING REMOVABLE SHAFT.

Referring to Fig. 3, it is seen that the armature and commutator is a distinct structure from the shaft. The shaft itself is perfectly plain and straight and can be immediately removed or inserted in the armature. This feature of a removable shaft allows armatures to be kept on hand wound for various speeds and voltages ready to receive shafts of any length or size which may be required and therefore prevents the unavoidable delay in filling orders where the shaft has to be made first, the armature fitted and wound, and commutator connected before the motor can be completed.

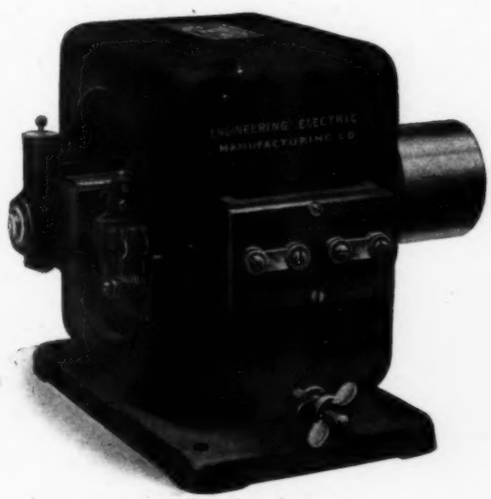


FIG. 1.—TYPE C MOTOR.

FIG. 2.—TYPE C ARMATURE IN CRADLE.

### A Strenuous Automobile Campaign.

That strenuous efforts are being made by the manufacturers of electric vehicles to impress upon the central station the enormous undeveloped field offered by these conveyances was evidenced by the comprehensive campaign carried on during the recent convention of the National Electric Light Association in St. Louis.

Prominent in this respect may be mentioned the Studebaker Automobile Company, who spared no expense in having the word "Studebaker" impressed on the minds of all present at the convention.

Hayden Eames, general manager of the Studebaker Company, presented at the second commercial session of the convention an interesting paper dealing with the electric-vehicle opportunity. He pointed out their wonderful possibilities, showing that in the city of New York, if only one-half of the horse-drawn vehicles were substituted by electrics, the income from the current at four cents per kilowatt-hour would amount to $52,000,000 per year.

These conditions exist in nearly every city, and as the central stations get the benefit of this enormous sale of current Mr. Eames said it was incumbent on them to take the initiative in educating the public as to the advantages of the electric over the horse-drawn vehicle. He also said that central stations must see to it that owners of electrics do not want to install independent plants.

In addition to presenting the question, so forcibly, to the delegates in session, the company maintained an exhibit in the Coliseum; it also provided large touring cars, in charge of expert chauffeurs, which were used to convey delegates from the hotels to the Coliseum.

Several unique methods were also employed in bringing the word "Studebaker" before the people. In the leading hotels there appeared on the menu card a "Studebaker salad." In the cafés the "Studebaker cocktails" became very popular, and even the theatres were not immune from the field of campaign, the players frequently alluding to a Studebaker car waiting for them.

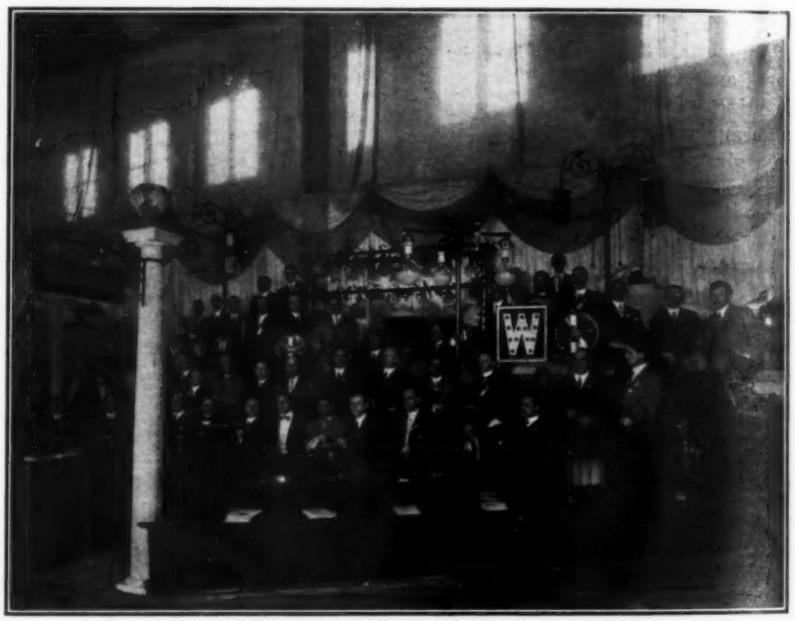
As a whole the campaign was very effective and those responsible deserve credit for their efforts, which will undoubtedly be productive of good results.

### Westinghouse Delegation at St. Louis.

The Westinghouse Electric and Manufacturing Company, as usual, had a representative group at its exhibit at the recent convention of the National Electric Light Association.

Owing to the fact that the annual meeting of the district managers of the Westinghouse Electric and Manufacturing Company was held at Pittsburg the previous week, the entire force of district managers, representing all of the large cities in the United States, accompanied by L. A. Osborn, second vice-president, and S. L. Nicholson, general sales manager, went to the convention in a body.

The accompanying illustration is a view of part of this delegation in the company's booth at the Coliseum, in St. Louis, at which there was exhibited a complete line of Westinghouse products, including power apparatus, current-consuming devices and miscellaneous apparatus.



WESTINGHOUSE DELEGATION AT ST. LOUIS, MO.

### Cahill Electrical Music Machinery Company to Build New Plant.

The Cahill Electrical Music Machinery Company has so far exceeded the capacity of its manufacturing plant at Holyoke, Mass., that it is planning to erect a new factory.

The Cahill electric-music plant located in Holyoke about seven years ago and met with success from the start. It is hoped to have the new plant in operation by the end of the year.

### The Frisco Extends Its Telephone Dispatching System.

The St. Louis and San Francisco Railroad, which has been active in the campaign among the railroad systems of the country to supplant the use of the telegraph with the telephone for train dispatching, is now installing new telephone circuits over about 500 miles of its line. The circuits now in course of construction extend from St. Louis to Springfield, Mo., from Springfield to Thayer, Mo., and from Amory, Miss., to Birmingham, Ala.

Trains on the Frisco are now being dispatched by telephone between Kansas City and Springfield, Mo., on the Northern Division, and on the Lebanon Division between Springfield and Monett, Mo., a total distance of about 246 miles.

The fact that the telephone-dispatching circuit in this busy district has proved satisfactory to the operating officials through the service it has given influenced their decision to extend this form of dispatching over more territory.

The equipment which is now in service and that which is soon to be installed consists of telephone apparatus and selectors purchased from the Western Electric Company. Message circuits, on which the commercial business is handled, parallel in every case the dispatching circuits, which are used exclusively to direct train movements and traffic.

# Current Electrical News

## GREAT BRITAIN.

*(Special Correspondence.)*

LONDON, MAY 27.—A. H. Stanley, who recently came from the United States to manage the District Railway has now been appointed managing director, in succession to Sir George Gibb, who has been appointed chairman of the new Road Board, created by the Government under the last Budget. Mr. Stanley was, a few months ago, appointed managing director of the London United Tramways Company, in succession to Sir Clifton Robinson, who is now in the Philippine Islands engaged in a tramway project. These new arrangements will allow a closer working between the underground section railways of London and the tramways in the West of London, although through bookings already exist.

The question of free trade and tariff reform is exercising the electrical industry here at present, and a meeting was held on Monday to deal with it. Naturally, there were too many speakers to conclude the discussion in one evening and it was adjourned until next week. At the meeting in question, there was an attendance of about 200, and undoubtedly the several feelings were in favor of a change in our fiscal arrangements.

The Board of Trade has definitely refused to renew the license for working the Dolter system of electric traction in Torquay. Apparently no complaints have been received from residents as to the danger of live studs, but the Board of Trade considers the number of these—about forty-five per week—is excessive, although it has been pointed out that relatively this number is small, as there are some 7,000 studs in Torquay. Furthermore, tramways would never have been agreed to in Torquay at all, except on the basis of the system not being the trolley. Certainly the operating company would prefer the overhead system, and now that the inhabitants have been educated to the usefulness of tramways, their aesthetic tastes will give way to the utilitarian, as has been the case at Bournemouth where even the conduit system is to be replaced by the overhead.

Glasgow will this year have the honor of welcoming the Municipal Electrical Association for its annual convention. One of the first subjects to be discussed is "Commercial Progress" in relation to electricity supply undertakings, and another matter, well worthy of consideration in view of the small consumer, is the cheapening of the cost of service and mains. Exhaust-steam turbines, and turbines generally, form another subject for discussion.

Attention continues to be bestowed upon the trackless-trolley system. Pending the acquisition of more experience of this system, it has been decided to defer the construction of tramways in Watford, near London. The lines in this town would form a portion of a comprehensive tramway system reaching to the boundaries of the County of London. It is hoped that the Bradford and Leed corporations will have their trackless-trolley systems running in a comparatively short time, and the Watford lines are to be proceeded with in the light of that experience.

Electricity supply is making enormous strides in Birmingham where the corporation is recommended to put in additional plant capacity to an estimated value of $700,000. G.

## CONTINENTAL EUROPE.

*(Special Correspondence.)*

PARIS, JUNE 1.—The municipality of Budapest is now operating two electric plants for the city supply, but as more current is needed at present it has been decided to erect a third plant. This is to be a turbine station, and it will be located at some distance from the city on the Soroksar, an affluent of the Danube. It is planned to use an output of 20,000 horsepower for the plant, and owing to the use of hydraulic power a cheaper supply can be obtained. Such current will be used for public and private lighting.

An exposition is to be held at St. Petersburg shortly which is concerned with the application of electricity to the Russian railroads, and it is expected to have many exhibits from the leading electrical firms which are engaged in this kind of work. The exposition will open on August 27 and is to last for three months. The first section relates to the substitution of electric power for steam on the railroads, the second section concerns the application of motors upon trunk lines, local lines and tramways, while the third section will contain exhibits relating to hydraulic power. From these exhibits the government and the various municipalities will draw much information on the subject.

It is likely that electric traction will be used on a section of suburban railroad line in the neighborhood of Bordeaux which runs from the city as far as St. André. The present section belongs to the state railroad lines.

In the Rhone region of France, the Rhone Power Distribution Company of Lyons is taking measures to supply the communes of Caluire and Cuire. I also note that the Rouen Traction Company has secured the rights for constructing two new sections of tramway in that city. The municipality of Trevoux is making arrangements with the Lyons Gas and Electric Company for a supply of current.

A tax is to be placed in Greece upon current which is used for lighting and heating, also upon gas and carbide. Parliament has recently passed a bill to this effect, and the government will receive ten per cent of the price obtained by the various companies which are engaged in such industries. Current which is used for motors is not to be included in these regulations.

In Sweden it is proposed to erect a turbine plant of considerable size upon the falls of Vakkokoski, and the greater part of the current is to be used for electric railroads in that region. The railroad administration has asked Parliament to vote a credit of 7,000,000 crowns for this purpose. The station will no doubt be located at a point between Torne-Track and Kiruna.

A. DE C.

## EASTERN CANADA.

*(Special Correspondence.)*

OTTAWA, ONT., JUNE 4.—Important extensions are being made by the Quebec Railway, Light, Heat and Power Company. The plans for the extension of the line of railway from the city of Quebec to Sillery, have been approved by the Board of Railway Commissioners, and the work of construction will be commenced at once.

Reports as to pole purchases have been received from forty-six telephone and telegraph companies; 151 electric-light, power and railway companies, and nineteen steam railways owning their pole lines. These represent 66,544 miles of line, supported by 2,422,245 poles.

The Montreal Light, Heat and Power Company has expressed to the city council of Montreal its desire to be relieved from the service of lighting the streets of the city. The company gave notice that it would terminate the present arrangement on October 31, and declared that it would rent its pole lines to the city should a municipal service be decided on.

The town of Farnham, Quebec, has passed a bylaw to raise $100,000 for power development. The proposition is to build a dam of concrete on the site of the old dam, and connect by canal with the lower dam. About 900 horsepower is provided.

Senator Mitchell, who has been visiting his coal properties in Nova Scotia, considers that the experiment of manufacturing electricity at the pit mouth, has proved a success. Other coal companies will soon adopt the same process. He said that his company had now over fifty miles of pole lines, and owns and operates the lighting plants of four villages besides the town of Amherst.

In Ontario, there are immense bodies of certain classes of iron ore, at present useless. They can only be utilized, apparently, by the introduction of electricity for smelting. For this the water powers are abundant and available. Electric smelting is practiced in Norway and Sweden while in Ontario it is not a question of knowledge but of application. In the matter of water powers, the Dominion Conservation Commission finds that, in Canada, there is a possible amount of 16,696,279 horsepower available, and only 514,890 horsepower developed. Apart from the soil, it is declared, the flowing waters are the greatest and most valuable undeveloped natufal resources, and they can never be exhausted.

An important judgment, affecting the water powers in non-navigable rivers and streams, has been rendered by the superior court of the province of Quebec. The property owners, along the Gatineau River, are the rightful and legal proprietors of the bed of the river. The importance of this judgment is due to the fact that there are very valuable water powers on the Gatineau, and it affects not only the property rights on that river, but also every river of a similar character in the province.

The Grand Trunk railway has under consideration a scheme for the electrification of its terminals in Montreal. The project is being taken up in conjunction with the elevation and quadrupling of its tracks between the city passenger terminus and Victoria Bridge over the St. Lawrence River. The eminently satisfactory results, that have followed the electrification of the St. Clair Tunnel, have led the company to go very carefully into the question of working all the trains within the terminal area by electricity. Estimates, as to cost and plans for the installation of the service, are now being prepared. W.

## MEXICO.

*(Special Correspondence.)*

MEXICO CITY, MEXICO, JUNE 4.—The formal transfer of the property of the Compania Electrica é Irrigadora in the state of Hidalgo to the Mexico Light and Power Company of Mexico City has taken place. The latter company is making good progress in the construction of its transmission line from its Necaxa hydroelectric plant to the Pachuca mining district. It will connect its system with the acquired plant and make important improvements and additions. The plant of the acquired company is now furnishing a limited amount of power to the mines in the district.

The Chapala Hydro Electric and Irrigation Company of Guadalajara, which was formed by the merging of the interests of Manuel Cuesta Gallardo and the Guadalajara Railway, Light and Power Company, is erecting a hydroelectric plant of 12,000-horsepower at Puente Grande on the Santiago River, state of Jalisco. The contract for the construction of the plant is being carried out by the Siemens & Schuckertwerke. The machinery for the first two units, each of 4,000-horsepower, has arrived at the site of the proposed plant. Another turbine and generator, necessary to bring the capacity of the plant up to 12,000-horsepower will soon arrive. The foundation for the building is being laid and it is expected that at least one of the units will be installed and in operation by some time this fall. The particular object of this new plant is to provide power for a number of mining districts of this state, including Hostotipaquillo, Etzatlan and Ameca. The line of steel towers to carry the transmission line has already been built to Hostotipaquillo and Etzatlan. The company contracted with a number of the larger mining companies operating in those districts to furnish them with power, beginning at a given date, and it is now forfeiting a considerable sum of money each day for failure to comply with its contract promptly. The delay in the construction of the plant is said to have been unavoidable.

It is reported that Dr. F. S. Pearson and associates, owners of the Mexico Northwestern Railroad and the Mexico Light and Power Company, who are establishing large industrial enterprises in this part of Northern Mexico, will also erect a large hydroelectric plant in Madera for the purpose of providing power for their lumber mills and other manufacturing plants. D.

## LIGHTING AND POWER.

*(Special Correspondence.)*

DAVID CITY, NEB.—This city has voted bonds for $40,000 for the improvement of the water and light system.

GREAT FALLS, MONT.—Twenty-seven five-light Tungsten cluster posts will be installed in the business district. C.

PORTLAND, ILL.—The city council is considering plans for equipment and a building for a municipal lighting plant. Z.

ADA, OKLA.—J. E. Smith and others are organizing a company to build a $500,000 power plant near Stonewall, Okla.

MOBRIDGE, S. D.—The council has granted a franchise to L. E. Pierce for an electric lighting plant to be put in at a cost of not less than $10,000. C.

ETNA, CAL.—W. N. Mullin has presented to the Board of Trustees a plan for a street lighting system. The Board will hand down a decision by June 14. A.

MERRILL, WIS.—The Merrill Electric Light Company will make extensive improvements in its service soon. It is stated that about $5,000 will be used. M.

DULUTH, MINN.—The Minnesota Canal and Power Company will shortly commence the construction of a power plant between West Duluth and Birch Lake. C.

GRANITE FALLS, MINN.—It is proposed to issue bonds for the construction of a dam and the improvement of the water power recently purchased by the city. C.

ST. PAUL, MINN.—The city of West St. Paul granted a franchise to the South St. Paul Light, Heat and Power Company to furnish the city with electric power. C.

SACRAMENTO, CAL.—Joseph Shaw has secured a franchise for a pole and wire line for the transmission of electricity on the public highways of Sacramento County. A.

WILMINGTON, DEL.—The Electrical Utilities Company has been organized by G. W. Dorsey, George W. May and John Seiler, of Wilmington, with a capital of $100,000.

MONTICELLO, ARIZ.—The Black Range Reduction Company will erect a hydroelectric plant near here for the purpose of providing power for its mill and mining machinery. D.

COLUMBUS JUNCTION, IOWA.—Utt Brothers, of Chicago, propose to rebuild the dam across the Iowa River between here and Wapello, and install a plant to generate electric power. C.

VIRGINIA, MINN.—Otto A. Poirier, secretary, park board, will receive bids up to 8 p. m., June 13, for forty-eight electric light posts, etc. A check for two per cent of the amount of the bid must be deposited. C.

RICE LAKE, WIS.—A contract has been made with the Red Cedar Valley Electric Company to furnish power and light to Rice Lake for a period of ten years. The company will have complete charge. M.

SULLIVAN, IND.—The Sullivan Electric Company has dissolved, the property having been taken over by the Sullivan Electric Light and Power Company, which is preparing to construct a new plant. S.

ROBINSON, ILL.—Work on the building for the new light plant has been commenced. A 250-horsepower oil engine and new dynamos costing $18,500 will be installed. Power will be sold to local industries. Z.

WILMINGTON, DEL.—The Kankakee Power Company has been incorporated by Warren N. Akers, Wilmington, Del., and William P. Brickett and Charles H. Weiss, of Chicago, Ill., with a capital of $600,000.

SAN BERNARDINO, CAL.—The Arrowhead Reservoir and Power Company has filed trust deeds amounting to $2,000,000, to raise money for constructing additional tunnels and building outlets for power for irrigation purposes. A.

QUERETARO, MEXICO.—The Ajuchitlan Mining and Milling Company which is operating mines near Ahorcado, this state, is increasing its electrical equipment. It obtains its power from the Queretaro Power Company of this city. D.

ALBANY, N. Y.—The Bolton Light and Power Company has been incorporated to do an electric light and power business. The capital is $25,000, and the incorporators are: F. R. Smith, D. L. Rogers, S. G. Finkle, Bolton Landing, N. Y.

ALAMEDA, CAL.—This city will spend approximately $15,000 in installing a receiving plant if the municipality purchases its current during the day time, for its electric light and power department. A.

DULUTH, MINN.—The West End Commercial Club favors the extension of the curb lighting system along Superior Street, from Eighteenth to Twenty-second avenue, at an estimated cost of $3,500. C.

BAKERSFIELD, CAL.—Work will begin this month on enlarging the Kern River power plant of the Power Transit and Light Company. When completed, the plant will supply 30,000 people with electricity. A.

SHERIDAN, MONT.—O. B. Preston, president of the municipal lighting plant in St. Johns, Mich., will, within four months, erect an electric lighting plant here. Indian Creek is the site for the power house. A.

MEXICO CITY, MEX.—R. Linton, superintendent of the Cole-Ryan mine, has arranged for the installation of a 300-horsepower steam-power plant to generate current for the operation of the Cole-Ryan properties. A.

GRANTS PASS, ORE.—Mr. Reed, manager of the Rogue River Water and Power Company, announces that a power plant is to be built on the Gold Hill Company's property and that his company has planned to spend $100,000 this year in developing power. A.

PIONEER, OHIO.—By a vote of about four to one this municipality has decided to issue bonds for the purpose of meeting expenses of lighting the village by electricity. The power will be furnished from West Unity, a village of about twelve miles distant.

RED LAKE FALLS, MINN.—The Red Lake Falls Milling Company sold its waterpower, electric lighting plant, etc., to the Red River Power Company and the property will be improved. The dam will be raised and an electric plant, of 2,500-horsepower put in. C.

FREEPORT, ILL.—The Stephenson County Lighting and Power Company is planning to authorize a bond issue for the purpose of constructing a power plant. It is said the Freeport Railway Light and Power Company may be consolidated with this concern later. Z.

LEON, MEXICO.—The Guanajuato Power and Electric company is constructing a 15,000-volt transmission line from Leon to Jalpa, the hacienda of Oscar Braniff. The line will run near the town of San Francisco del Rincon where power and light will be sold. D.

DOUGLAS, ARIZ.—The Heffern Mining and Development Company which is operating mines and reduction works about twenty miles from Douglas will erect a hydroelectric plant for the purpose of furnishing power and lights for its own use and for towns of this section. D.

SAN FRANCISCO, CAL.—The Sierra-San Joaquin Electric Company will this year erect a power plant capable of developing 8,000 horsepower. The plant will be located twenty-five miles from Porterville and supply light to Taft and Maricopa as well as the Kern and Midway oil fields. A.

DUNKIRK, IND.—The American Gas and Electric Company, of New York, has purchased the Dunkirk lighting plant and will make improvements. The company owns the Hartford City, Marion and the Red Key lighting plants and it is predicted a great central station will be installed to furnish current to all these plants. S.

ATLANTA, GA.—In United States court Judge Newman has authorized the sale of the North Georgia Electric Company's property by receiver H. H. Dean, at $400,000, in a suit in equity brought

by the Knickerbocker Trust Company, of New York, against the electric company named above. L.

ORLEANS, CAL.—As soon as the Company that has taken up the water power at Ishi Pishi Falls, receives its permit from the Government, work will begin on a $300,000 power plant at Ishi Pishi Falls. The company expect to spend $1,00,000 in Humbolt county within the next two years. A.

HUNTINGTON, IND.—The Huntington Light and Fuel Company has opened its new plant and for the first time since November, 1890, the natural gas service gives way to the artificial product. The company's new plant, including machinery and electric apparatus, cost upward of a million dollars. S.

GREENSBURG, IND.—The Central Station Engineering Company, of Chicago, has secured a franchise for the installation of a steam heating plant in this city. The grant provides, however, that if a local company will raise sufficient capital to cover the expense of installing the plant, the franchise will revert to the local company. S.

LOS ANGELES, CAL.—The Board of Public Works has recently placed an order with Allis-Chalmers Company for twenty-one 440-volt, three-phase, sixty-cycle, belted induction motors for use in connection with the work on the new water supply aqueduct. Seven of these are 125 horsepower and the rest range down to ten horsepower.

CARTHAGE, IND.—L. A. Brennan, who has recently purchased the dominant interest in the Carthage electric-light plant, announces that he will purchase and install a 100-horsepower gas engine to furnish current for the town and immediate territory. An electric motor pumping outfit and other electrical equipment will be added to the plant. S.

BEACH, N. D.—The city will install an electric light plant. A power station will be erected, brick or concrete, to be equipped with a 150-horsepower compound engine, direct connected, sixty-cycle three-phase alternator and a 150-horsepower boiler. A deep-well pump and feed-water heater will be installed. The plant is to be completed by September 1. C.

ATLANTA,GA.—J. R. Gordon, and John R. Dickson, both of Fulton County, and Z. W. Summerour of Union County Ga., have applied for a charter for the Coosa Creek Power and Mining Company, with $500,000, capital stock, par value $10 per shore. Privilege is asked to increase at any time to one million dollars. The principal office is at Atlanta, Ga.

IXMIQUILPAN, STATE OF HIDALGO, MEXICO.—Engineer J. C. Azan and associates will erect a hydroelectric plant of 5,000 horsepower on the Tonantongo River, about fifteen miles east of here. Mr. Azan is now making the surveys for the proposed plant. Transmission lines will be constructed and the power conveyed to the districts of Zimapan, Actopan and Ixmiquilpan. D.

SAN FRANCISCO, CAL.—The Pacific Gas and Electric Company has purchased the electric light holdings of E. D. M. Lehe of Dixon, Cal. Mr. Lehe owned the lighting plants at Wheatland, Lincoln, Davis, Roseville, Cordelia, Elmira, Winters, Dixon, Rio Vista and Benicia. The new owners intend to develop these plants and extend the lighting system to the surrounding rural districts. A.

DOUGLAS ARIZ.—Phelps-Dodge & Company and other mining interests of this section are considering the proposition of joining forces in the erection of a large electric power plant at Douglas. It is proposed to construct transmission lines to the Tigre and other mining districts. The power will also be used to operate an electric railway that is to be constructed from the Tigre district to the town of Yzabel. D.

KNOXVILLE, TENN.—W. J. Oliver, of this city, has secured the contract to build a 9,000-horsepower plant on the Watauga River, eight miles from Elizabethton. Auxiliary steam power will also be developed in Bristol. The plant will furnish power for Bristol, Johnson City and Elizabethton. Tennessee capital is building the plant, and will build a similar plant on the Watauga and another on the Doe River.

CRAWFORDSVILLE, IND.—By a large affirmative vote the citizens of this city expressed their desire that a new electric light and power plant be constructed here. The new plant as now planned would cost $100,000. The present municipal plant is operated by a board of trustees, and a portion of the cost will be provided for by a bond issue. The city council has authorized the trustees to proceed to contract for a new plant. S.

GUADALAJARA, MEXICO.—The Chapala Hydroelectric and Irrigation Company has met with unexpected obstacles in the construction of its hydroelectric plant and transmission system. The work of constructing the transmission line to the Hostotipaquillo, Etzatlan and other mining districts of the state of Jalisco has been resumed, and it is announced that the company will be ready to furnish power for those districts by October 1. D.

QUINCY,ILL.—The Quincy Gas, Electric and Heating company, with a franchise thirteen years to run has an application for a new permit under the underground wire ordinance, before the city council. The city wants the new grant for less than thirty years and an increased per cent of the earnings. J. T. Lynn of Detroit, Mich., says the company will withdraw its petition if necessary and operate under the old franchise. Z.

ATLANTA, GA.—The Atlanta Hydro-Electric Power Company has been organized with a capital stock of $3,000,000, and has placed shares on the market at $100. The location of the proposed plant is in the northern part of Georgia on the Tugaloo River. It is proposed to construct a dam 120 feet in height across the river at a point about two miles below the junction of the Chattooga and Tallulah rivers. It is calculated that there will be available about 16,000 horsepower.

SANTA ROSA, STATE OF CHIHUAHUA, MEXICO.—The Mexican Northern Power Company estimates that its proposed hydroelectric plant and transmission lines in this state will cost about $7,000,000. Approximately one million dollars has already been spent in the necessary preliminary work. Good progress is being made in the construction of the main dam across the Conchos River, about fifteen miles from Santa Rosa, 750 men being employed in that work. D.

MEMPHIS, TENN.—The Little Missouri Water Power Company, which proposes to construct two dams on the Little Missouri River above Murfreesboro, Ark., has filed its articles of incorporation with the secretary of state. The company is capitalized at $100,000. The company plans to supply waterpower for the operation of light and other plants within a radius of forty miles of its plant. This will include the towns of Arkadelphia, Hope, Prescott, Texarkana, Ashdown and DeQueen.

COLLINSVILLE, ILL.—Jacob J. Frey, E. B. Hess and others of Hillsboro, Ill., were granted a thirty-year franchise to operate an electric light plant in this city and also a contract to furnish light for the city for ten years. The Frey company will take over the old plant for $25,000 and in addition will spend $150,000 in improvements, one of the provisions of the franchise being that a new plant must be erected and in operation within six months. The company will enter Maryville, Caseyville and probably other towns near here. Z.

MICHIGAN CITY, IND.—Clarence H. Geist of Chicago and Philadelphia while in this city May 26, denied the rumors to the effect that he is disposing of his interests in the Northern Indiana gas and electric properties located in this city, Valparaiso, Chesterton, Hammond, Whiting, East Chicago and South Chicago. On the contrary he stated that he and his associates are buying up all the scattered stock in the mammoth concern. He also stated that a large sum will be expended on improvements and new equipment during the year. S.

FOLLANSBEE, W. VA.—Follansbee Brothers Company is now making arrangements to greatly increase the capacity of its steel mill. Electric drive will play an important feature in the changes that are being made and to supply the necessary power an order has been placed with Allis-Chalmers Company for a low-pressure turbine. This will be a 1,500-kilowatt, 1,500-revolution-per-minute, 2,300-volt, three-phase, twenty-five-cycle machine with an exciter coupled to an extension of the shaft. Steam for this unit will be supplied from the exhaust of the present engines.

MARINETTE WIS.—The power plant of the Menominee and Marinette Light and Traction Company on the Menominee River is practically completed, and it is expected to have it in operation June 15. This plant will develop 6,000 horsepower, a large part of which will be used in this place and Menominee. The local organization of business men is making a strong effort to interest capital in developing the waterpower sites in the vicinity of this place, which are capable of developing from 500 to 7,000 horsepower. M.

WATERBURY, CONN.—The contract for the construction of the new steam generating plant in this city for the Connecticut company has been awarded to Fred T. Ley & Company, of Springfield. The total cost of erection and equipment is estimated at approximately $150,000. The power house will be a one and a half story structure, 98x151 feet, and will have a floor space of 14,798 square feet. The initial equipment will consist of two 1,500-kilowatt generators, and provision will be made for the installation of additional ones as the needs of the company may require. The plant is to be completed by fall.

LOS ANGELES, CAL.—The Sierra-San Joaquin Electric Company, with $5,000,000 capital, has been incorporated by local capitalists. This company has been formed for the development of power on the Tulare River in Tulare County and will operate in connection with the Pacific Light and Power Corporation and the San Joaquin Light and Power Company in supplying electricity to the southern half of the San Joaquin Valley. Within the next year the Sierra-San Joaquin Electric Company will spend about $2,000,000 in the construction of dams and an 8,000-horsepower plant, twenty-five miles above Porterville. A.

PACHUCA, MEXICO.—The Companies de Luz, Fuerzay y Ferrocarriles de Pachuca has been organized with a capital stock of $1,500,000, all paid in, for the purpose of establishing large electrical enterprises in Pachuca and this vicinity. The company will install a hydroelectric plant and acquire water power rights, construct and operate an electric street-railway system, and furnish power for mines and other industries. The board of directors is composed of a number of men of wealth, including Joaquin D. Cassasus, Jacinto Pimentel, Jose Luis Requena, all of Mexico City; Leandro F. Payro and Rafael M. Arozarena of Pachuca. Mr. Cassasus is president. Theodore Brandenburg is general manager. D.

## ELECTRIC RAILWAYS.

*(Special Correspondence.)*

BOZEMAN, MONT.—It is proposed to build an electric line to Maudlow, forty miles north of here. C.

BRECKENRIDGE, MINN.—Work has been commenced on track laying for the street railway to Wahpeton, N. D. C.

HAMMOND, LA.—The Hammond Interurban Railway Company has been organized with a capital stock of $1,000,000.

NEW ORLEANS, LA.—H. C. Warmoth has secured $1,500,000 in New York to build the new electric railroad from this city to Algiers.

BILLINGS, MONT.—Plans have been completed for an electric line to Bearcreek, via Laurel, Rockvale, Belfry and Fromberg, to cost $5,000,000. C.

EL CENTRO, CAL.—The Imperial Valley Railway Company has been incorporated by F. W. Holt and associates, with a capital stock of $2,000,000.

BAKERSFIELD, Cal.—A fifty-year franchise for a single or double track electric railroad has been granted the Power Transit and Light Company.

BOONE, IOWA.—The Fort Dodge, Des Moines & Southern Railway Company is making improvements to its power plant, aggregating $65,000. C.

DECATUR, ILL.—Pay-as-you-enter cars will be installed on the city lines here early in October. Cars now in use will be rebuilt for the purpose. Z.

RAYMOND, WASH.—P. E. Hall Jr., owner of the South Bend electric-lighting system, has applied for a forty-five-year franchise for an electric street-railroad system here.

VALLEJO, CAL.—The stockholders of the Vallejo & Northern Electric Railway will hold a meeting on July 28 to vote upon the proposition of increasing the capital stock $2,500,000 to $10,000,000.

ANDERSON, IND.—The directors of the Indiana Union Traction Company have elected officers as follows: President, A. W. Brady; general manager, Harry A. Nicholl, and secretary, W. H. Forse. S.

ONTARIO, ORE.—Henry Lewitt has applied for an electric street-railway franchise. It is stated that the new line will connect at Snake River, near Nyssa, with the Pierce line to Caldwell. A.

WASHINGTON, D. C.—A bill has passed the House to grant the right to W. A. Wall and others to build an electric railroad in Honolulu, Territory of Hawaii, and operate same for a period of thirty years. F.

FORT WORTH, TEXAS.—The Forth Worth Board of Trade has under consideration the proposition to raise $300,000 to aid in financing the construction of an interurban electric railway between this city and Cleburne. D.

LOS ANGELES, CAL.—Geo. I. Lamy, in the Central Building is organizing a company, principally of Riverside people, to build and operate a road between Pedley Station, on the Santa Fe, and San Jacinto, a distance of thirty-two miles. A.

ELKHART, IND.—H. E. Bucklen announces that he will proceed at once with the work of building an extension of the St. Joe Valley traction line from Angolia to Toledo. When this extension is completed Elkhart and Toledo will be connected. S.

INDIANAPOLIS, IND.—The city council has granted a franchise to the Indianapolis, New Castle & Toledo Traction line to enter the city by way of Twentieth Street and Massachusetts Avenue. This makes the twelfth interurban road to enter the city. S.

LOS ANGELES, CAL.—The line of the Los Angeles Railway which now extends to the intersection of Thirty-ninth Street and Vermont Avenue, will be extended from Vermont to Western Avenue. A double track, one mile in length, is to be laid.

PEORIA, ILL.—The Illinois Traction System will spend $8,000,000 in improvements this year according to General Manager H. E. Chubbuck of this city. Six electrical locomotives for use in freight business between East St. Louis and St. Louis have been ordered. Z.

CHATTANOOGA, TENN.—Secretary F. T. Reynolds, of the Chattanooga chamber of commerce declares that Chattanooga and Dalton, Ga., will be connected by trolley within a short while. He adds that northern capitalists are ready to proceed with the undertaking. L.

BLUFFTON, IND.—The Bluffton, Geneva and Celina Traction Company has opened its new line for service. The road is an extension of the Marion, Bluffton & Eastern Traction Company and will be further extended. A new portable substation has been added to the power equipment. S.

SAN FRANCISCO, CAL.—The city treasurer has received from the United Railroads Company, $34,274.25, which is amount due the city as percentages on the gross receipts of the company for the year 1908. There is still unpaid, the amount due for 1909, estimated to be about $40,000.

SAN FRANCISCO, CAL.—George W. Peltier, president of the Central California Traction Company, announces that the construction work on the electric line between Sacramento and Stockton is nearly completed. Within six months, a fifteen minute service on this line will be established.

ATHENS, GA.—The state railroad commission has authorized the Athens Railway and Electric Company to issue $1,875,000 stocks and bonds, this company being formed to take over the properties of the old Athens Electric Railway. Of the new issue $750,000 will be common and $300,000 preferred stock, and $825,000 will be in interest-bearing bonds. L.

CONCORD, N. C.—The new electric street railway will be in operation by July 1, according to the promoters of the new line in Concord. The Piedmont Carolina Railway Company is building the Concord lines, and has also recently consummated the purchase of the majority of the stock of the Salisbury-Spencer Interurban line, this deal being put through in Grand Rapids, Mich., by W. F. Snider of the Piedmont Company. L.

TRENTON, N. J.—The Elizabeth & Trenton Railroad Company has been incorporated with an authorized capital stock of $1,200,000. The company is to take over and operate the trolley road of the Trenton & New Brunswick Company, which was sold on May 4 under mortgage foreclosure. The new company will also take over the road and franchise of the New Jersey Short Line Railroad Company, which is an extension of the main line.

INDIANAPOLIS, IND.—The amount of issue of the Terre Haute, Indianapolis & Eastern Traction Company bonds sold to Drexel & Company, Philadelphia, and Lee Higgins & Company, and Esterbrook & Company, of Boston, was $5,500,000. The bonds bear five per cent interest. The company has completed its acquisition of a controlling interest in the stock of the Indianapolis Traction & Terminal Company and the two interests are merged. S.

HIGHLAND, ILL.—Madison County residents will meet here June 23 to further a movement for securing an interurban line between Troy, St. Jacobs and Highland and perhaps connect with the East St. Louis and Suburban at Maryville and the McKinley lines at Staunton. Prominent in the movement are J. C. Ammann and Eugene Schott of Highland; Capt. I. W. Cook and W. W. Jarvis of Troy, Rufus Pike of St. Jacobs and Joseph Long of New Douglas. Z.

MINERAL WELLS, TEXAS.—The Mineral Wells Electric Company has been organized with a capital stock of $350,000. Its charter was recorded at Shreveport, La., but it is reported that its purpose is to construct and operate an interurban electric railway between Fort Worth and Mineral Wells. The officers of the company are: S. B. Canty of Fort Worth, president; Newton C. Blanchard of Shreveport, La., vice-president; W. C. Forbes of Fort Worth, secretary. D.

PHILADELPHIA, PA.—The property of the Holmesburg, Tacony & Frankford Railroad Company was purchased by George B. Atlee & Company for $375,000, at public sale recently. The property was sold under decree of the United States District Court, and the sale was conducted by Andrew T. Freeman. The purchasers, it is understood, represent interests which will operate the road. The sale of the property was ordered as the result of a suit instituted by the bondholders.

BROWNSVILLE, TEXAS.—The city council has granted a franchise to B. G. Stegmon for the construction of an electric street-railway system over the principal business and residence streets of Brownsville. The franchise requires construction work to be started within four months from the date it was granted, that three miles of track be finished and in operation within one year and the whole system finished within two years. The franchise is for twenty-five years. The fare within the corporate limits of town shall be five cents except in the case of school children who shall be charged only three cents. D.

SALISBURY, N. C.—The organization of the combined interests of the Salisbury Electric Railway, and of the company operating between Spencer and Salisbury, has been effected under the name of the Salisbury-Spencer Electric Company, capital stock $400,000. New officers are as follows: President, W. F. Snyder, cashier of the Wachovia bank; vice-president, T. H. Vanderford; secretary T. J. Jerome; treasurer, W. F. Snyder; superintendent, H. W. Frund; attorneys, Clement and Clement, and Jerome and Manness. The company will operate an interurban line between the two towns named, and also a system in Concord, twenty-five miles distant. L.

BRIDGEPORT, CONN.—The Bridgeport & Danbury Electric Company will early this summer begin the construction of an interurban trolley line for which it holds the franchise. The preliminary estimates indicate that the construction and equipment of the road, which will be a little over twenty miles long, will cost something over $800,000. The line will run through the towns of Bridgeport, Trumbull, Munroe, Newton, Bethel and Danbury and will serve a population of about 135,000. The preliminary surveys are now being pushed. It is intended to have the route laid out over private rights of way as far as possible. It is probable that the power station will be located at Stepney. One of the backers of the enterprise is Morton F. Plant, of New London, the millionaire railroad and steamboat man. The company has an authorized capital stock of $1,500,000. The interests identified with the Bridgeport & Danbury company have recently acquired control of the Danbury & Bethel Street Railway Company.

## TELEPHONE AND TELEGRAPH.

*(Special Correspondence.)*

GUNDER, IA.—The Marion Telephone Company has been incorporated with a capital stock of $4,000.

GRANT, NEB.—The Grant Telephone Company has been incorporated with a capital stock of $4,000. P.

VIRGIL, S. D.—The Virgil Telephone Company has been incorporated with a capital stock of $10,500.

LENAPAH, OKLA.—The City Telephone Company has been incorporated with a capital stock of $10,000. P.

CURTIS, NEB.—The Curtis & Fox Creek Telephone Company has been incorporated with a capital of $5,000. P.

HOBART, OKLA.—The Lawrence Telephone Company has been incorporated with a capital stock of $6,000. P.

KAUKAUNA, WIS.—The Kaukauna Telephone Company has increased its capital stock from $5,000 to $10,000. C.

ROCK SPRINGS, TEX.—The Rock Springs Telephone Company has been incorporated with a capital of $15,000. P.

FERGUS FALLS, MINN.—A telephone franchise has been granted to Ludwig Jensen, S. M. Skrove and others. C.

SAUK CENTER, MINN.—The Northwestern Telephone Exchange Company is about to install a magneto telephone system.

OKLAHOMA CITY, OKLA.—The East View Rural Telephone Company has recently been incorporated with a capital stock of $6,000. P.

MILWAUKEE, WIS.—The Wisconsin Telephone Company will construct a new telephone line to Madison, Wis., at a cost of $75,000. C.

TWO RIVERS, WIS.—The government is surveying for a telephone line between the life saving station and the Twin River Point light house. C.

PULASKI, WIS.—The Pulaski Merchants and Farmers Telephone Company will construct telephone lines between Green Bay and Shawno and Flintville and Elm Grove. C.

ALBANY, N. Y.—The Wayne Telephone Company has been incorporated by W. P. Rogers, Williamson, H. P. McDonough, Newark, and F. D. Gaylord, Sodus, with $250,000 capital.

ASHEBORO, N. C.—Charles T. Ingram, manager of the Southern Bell Telephone Company at High Point recently announced that the company would enter Asheboro inside of a few weeks. L.

BIG SANDY, MONT.—The North Montana Telephone Company has been organized to construct telephone lines from here to Box Elder, and to Chester and Havre. Poles and wire have been ordered. C.

CLEAR LAKE, IOWA.—The Western Electric Telephone Company has purchased a majority interest in the Clear Lake Independent Telephone Company and will commence extensive rebuilding of the line. C.

ST. JOHN, IND.—The Northwestern Telephone Company with chief exchange in this city, has increased its capital $25,000. The company is now in the market for material to make extensions and improvements in the plant. S.

EL PASO, TEXAS.—The Bell Telephone and Telegraph Company has come into possession of the Southwestern field in to California by acquiring the Silver City, El Paso Southwest Telegraph and Telephone Company.

DECATUR, ILL.—Walter Hutchin has been appointed business manager for the Decatur Home Telephone company succeeding J. A. Portwood who is manager of the newly organized Macon County Telephone Company. A. V. Brown will be auditor of outside exchanges for the Macon County company. Z.

SCOTTSVILLE, VA.—The town council has granted a telephone franchise to E. W. Twyman, of Charlotesville, and the Scottsville Telephone Company will be organized at once. The company will operate in the counties of Albemarle, Fluvanna and Buckingham and the town of Scottsville. The line will also have connection with Charlottesville.

VERA CRUZ, MEXICO.—The Vera Cruz Telephone Syndicate, which obtained a concession to construct and operate telephone exchanges and long-distance lines in this state, has acquired the old telephone system in this city and is placing the cables underground and installing new equipment. It is constructing long-distance telephone lines between Vera Cruz and the cities of Orizaba, Cordoba, Jalapa and other places in the state. It expects to have its long-distance lines finished and in operation in a few more weeks.

TOLEDO, OHIO.—The Bell Telephone Company has increased its long distance rates in this section, the raise taking effect on June 1. The rates were greatly reduced about a year ago as the result of a rate war and the present schedule brings them back to the old figures and in some cases higher. Whereas the rate has been thirty cents to Cleveland, the new rate is sixty-five cents. To Detroit an increase has been made from fifteen cents to forty cents; Columbus, from thirty-five cents to seventy-five cents and to Dayton from forty-five cents to eighty-five cents. Rates to other points are increased correspondingly. H.

## ELECTRICAL SECURITIES.

With the exception of the government's attempt to prevent the western railways from raising their freight rates all the developments of the past week were favorable to the general stock market.

Good crop reports, lower prices for farm products, improving foreign trade, liberal European purchases of American securities and the reduction of the Bank of England's discount rate to three and one-half per cent were among the incidents that ordinarily would have contributed to cheerfulness in financial circles.

They were all more than offset, however, by the consternation caused by the Attorney General's unexpected action in obtaining an injunction against the railways.

The $5,500,000 Terre Haute, Indianapolis & Eastern Traction Company first and refunding mortgage five per cent bonds, offered by Drexel & Company, Lee, Higginson & Company and Estabrook & Company have all been sold.

Earnings of the Philadelphia Rapid Transit Company for May exceeded those of a year ago, but the margin of increase was not very large and was entirely due to the heavy receipts of Memorial Day and the Sunday and Saturday preceding. On these three days the receipts were more than $200,000—a very high figure.

The May gross of the Massachusetts Electric Companies showed a gain of $31,600, or five per cent, which compares with an April increase of $53,800, or 9.8 per cent, a March gain of $60,060 or 11.6 per cent and a February gain of $50,100, or ten per cent.

The Consolidated Gas, Electric Light and Power Company, of Baltimore, has sold to E. H. Rollins & Sons, of Boston and New York, $4,000,000 of three-year five per cent collateral notes. The proceeds will be used to redeem $3,584,500 of six per cent bonds of the old Consolidated Gas Company which mature July 1. The company also is arranging to exchange $548,000 of four and one-half per cent general mortgage bonds issued by the old Consolidated Gas Company for a like amount of the bonds issued under that mortgage and sold to the public, but which the Maryland Court of Appeals has decided are not entitled to the security of the mortgage.

### DIVIDENDS.

Indianapolis Street Railway Company; semiannual dividend of three per cent, payable July 1.

Interborough Rapid Transit Company, quarterly dividend of two and one-quarter per cent, payable July 1.

Niagara Falls Power Company; $2 per share, payable July 25.

Philadelphia Union Traction Company; semiannual dividend of $1.50 per share, payable July 1.

Safety Car Lighting and Heating Company; quarterly dividend of two per cent, payable July 1.

Twin City Rapid Transit Company; Common quarterly dividend of one and one-half per cent, payable July 1.

### NEW YORK.

| | June 6. | May 30. |
|---|---|---|
| Allis-Chalmers common | 8 | 9½ |
| Allis-Chalmers preferred | 31 | 32 |
| Amalgamated Copper | 64 | 69⅝ |
| American Tel. & Cable | *80 | *80 |
| American Tel. & Tel. | 133¼ | 136½ |
| Brooklyn Rapid Transit | 76⅞ | 80⅞ |
| General Electric | 141 | 148½ |
| Interborough-Metropolitan common | 17⅞ | 20⅛ |
| Interborough-Metropolitan preferred | 48⅝ | 54½ |
| Kings County Electric | 123 | 124 |
| Mackay Companies (Postal Telegraph and Cables) common. | 84 | 87¾ |
| Mackay Companies (Postal Telegraph and Cables) preferred. | 75 | 75½ |
| Manhattan Elevated | 132 | 134 |
| Metropolitan Street Railway | *18 | *18 |
| New York & New Jersey Telephone | 103 | 103 |
| U. S. Steel common | 76½ | 82½ |
| U. S. Steel preferred | 115 | 117⅝ |
| Western Union | 64 | 67⅝ |
| Westinghouse common | 59½ | 63¼ |
| Westinghouse preferred | *110 | *110 |

*Last price quoted.

### BOSTON.

| | June 6. | May 30. |
|---|---|---|
| American Tel. & Tel. | 133¼ | 136½ |
| Edison Elec. Illuminating | 248 | 250 |
| General Electric | 141 | 148½ |
| Massachusetts Electric common | 16½ | 17½ |
| Massachusetts Electric preferred | 86 | 85¾ |
| New England Telephone | 133 | 133½ |
| Western Tel. & Tel. common | 15½ | 15½ |
| Western Tel. & Tel. preferred | 86 | 88 |

### PHILADELPHIA.

| | June 6. | May 30. |
|---|---|---|
| American Railways | 44 | 45 |
| Electric Company of America | 11½ | 11¾ |
| Electric Storage Battery common | 57 | 59 |
| Electric Storage Battery preferred | 57 | 59 |
| Philadelphia Electric | 14¾ | 15 |
| Philadelphia Rapid Transit | 18 | 18 |
| Philadelphia Traction | 84⅞ | 85 |
| Union Traction | 46½ | 47½ |

### CHICAGO.

| | June 6. | May 30. |
|---|---|---|
| Chicago Railways, Series 1 | 50 | 70 |
| Chicago Railways, Series 2 | 16 | 17 |
| Chicago Subway | 2½ | 2½ |
| Chicago Telephone | 116 | 116 |
| Commonwealth Edison | 112 | 112 |
| Metropolitan Elevated common | 16 | 16 |
| Metropolitan Elevated preferred | 52½ | 52½ |
| National Carbon common | 107 | 109 |
| National Carbon preferred | 118 | 118 |

## PERSONAL MENTION.

DR. H. W. MORSE has been appointed to an assistant professorship of physics, and Dr. L. J. Henderson to an assistant professorship of biological chemistry at Harvard University.

BRIGHT C. TABER, president of the Taber Pump Company, Buffalo, N. Y., sailed for Europe a short time ago on the *Philadelphia*, and expects to spend the summer visiting different parts of the Continent.

F. J. MAISEN, who for the past two years has been manager of the Central Union Telephone Company at Fremont, Ohia., has been transferred to Galion, Ohio. He will be succeeded by W. E. Stump, of Toledo.

W. W. DEARTH, who, it was announced in these columns, had been made manager of the Pana Gas and Electric Company, Pana, Ill., states that this is not the case. There has as yet been no manager appointed and Mr. Dearth is temporarily looking after the plant until an appointment is made.

L. H. CHALMERS, president of the Pacific Gas and Electric Company, of Phoenix, Ariz., has returned from Washington, D. C., where he went to oppose the validation by Congress of the proposed Phoenix, Ariz., bond issue of $300,000 for the installation of a municipal light and power system.

ALBERT KATTERHEINRICK, who for the past four years has been an employe of the Ft. Wayne and Springfield Railway Company, rising rapidly from bookkeeper to auditor and general passenger and freight agent, has resigned to take a position as assistant auditor for the Chicago & South Bend Company.

N. A. CARLE announces that he has opened an engineering office at No. 510 Central Building, Seattle, Wash., and is prepared to do consulting and constructing work in mechanical, electrical and mining engineering. He is especially equipped to make examinations and reports on steam, electric and waterpower plants and mining properties.

A. A. ANDERSON, general manager of the Indianapolis, Columbus & Southern Traction Company for the past four years, has resigned and gone to Springfield, Ohio, where he has accepted of a similar position with an Ohio Company. Will G. Irwin, vice-president of the Indianapolis, Columbus & Southern, will temporarily act as general manager.

## OBITUARY.

PATRICK J. BURKE, a pioneer in electric railway construction, and member of the Old Time Telegraphers' Association, died recently at his home in Cheshire, Conn., at the age of sixty-four years. Death was due to kidney trouble. A widow and three children survive. In early life Mr. Burke built many telegraph lines in New York state, Missouri, and other sections of the country.

CHARLES A. FLACK, president of the American Conduit Manufacturing Company of Pittsburg, Pa., died on Monday, May 30, at his home in Parnassus, Pa., after a long illness. Mr. Flack has been closely associated with the company from the time of its inception, holding the office of president for seven years. At the time of his death he had, owing to his illness, been out of the active work for about a year.

AUSTIN R. SEAGROVE, former street railway promoter, died at the Toledo Hospital, a short time ago. He was one of the officers of the Central Passenger Railroad in 1875 when that company constructed the Erie & Western electric line in Toledo, and later promoted the Nebraska Avenue & Lagrange lines. He was seventy-five years old at the time of his death, and is survived by one daughter. He was born in Andover, Mass., January 4, 1835, and was appointed Indian Agent for Ohio reservations in 1870.

## PROPOSALS.

NAVY DEPARTMENT SUPPLIES.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will open bids on naval supplies on the dates given below. Bidders interested therein should make early application for copies of the schedule, giving the schedule numbers desired. Schedules can be obtained from the Navy Pay Office nearest each navy yard. Bids will be asked on the following supplies:

| Date of Opening. | Material. | Quantity. | Place of Delivery. | Schedule No. |
|---|---|---|---|---|
| June 14— | Motor-generator set | 1 | Philadelphia, Pa. | 2557 |
| | Panels, flame proof | 18 | Boston, Mass. | 2563 |
| | Wire, rubber covered | 27,000 feet | Brooklyn, N. Y. | 2554 |
| | Drill, radial, motor driven | 1 | Norfolk, Va. | 2550 |
| | Drill, radial, motor driven | 1 | Norfolk, Va. | 2552 |
| June 15— | Incandescent lamps | Annual supply. | Various | 2548 |
| June 28— | Machine, milling, No. 5, high power, universal, motor driven. | 1 | Mare Island, Cal. | 2551 |
| | Machine, milling, No. 4, high power, vertical, motor driven. | 1 | Mare Island, Cal. | 2551 |

POST OFFICE, MINNEAPOLIS, MINN.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until June 27 for the construction (including plumbing) of the United States Post Office at Minneapolis, Minn., in accordance with drawings and specification, copies of which may be had from the custodian of site at Minneapolis, Minn., or at the supervising architect's office.

## INDUSTRIAL ITEMS.

THE FEDERAL SIGN SYSTEM (Electric), has opened a branch office in Pittsburg, Pa., at No. 3 Wood Street, under the management of L. F. Bruce, to provide for the demand for Federal electric signs, fixtures and specialties in that district.

THE NATIONAL METAL MOLDING COMPANY, Pittsburg, Pa., recently mailed a folder illustrating some installations of "National" metal molding. Several notable buildings are listed as containing this rust-proof, fire-proof and nail-proof metal molding.

THE EVERSTICK ANCHOR COMPANY, St. Louis, Mo., has distributed a unique folder calling attention to the quickness with which an Everstick anchor can be installed. The five operations to be gone through with, as shown in the folder, take a total time of about nine minutes.

THE UNITED STATES LIGHT AND HEATING COMPANY, New York, N. Y., describes in bulletin No. 105, its National storage batteries for railroad passenger-car lighting. The elements, tanks,, lead lining, rubber jars, and accessories are quite fully described and a number of illustrations are given.

THE GENERAL VEHICLE COMPANY, Long Island City, N. Y., recently published its June number of *Elec-Tricks*, containing some interesting items on the electric vehicle. In connection with a letter from one of the companies using G. V. Electrics, a double-page illustration of a line of these vehicles is given.

THE ILLINOIS APPLIANCE COMPANY, 167 Dearborn Street, Chicago, Ill., has ready for distribution an attractive booklet devoted to its adaptable massage-vibrator. This device which is an innovation in the way of a low-priced, efficient vibrator, is described fully and illustrated in the booklet, which also presents interesting data regarding specifications, use, etc.

THE BARKELEW ELECTRIC MANUFACTURING COMPANY, Middletown, Ohio, describes, in its new catalogue No. 20, its line of knife switches and specialties. The switches in this catalogue are all copper and are approved and listed by the Underwriters' National Electric Association under the rules and requirements of the National Board of Fire Underwriters.

THE LINTON MACHINE COMPANY, New York, N. Y., has perfected its "Komo" steam trap which is described in a recent booklet. This steam trap is so constructed as to remove the water of condensation from steam as quickly as it is formed, thus saving fuel. The action of the trap is fully explained in the booklet and several illustrations and diagrams are given.

THE "CARB-OX" COMPANY, Chicago, is sending out catalogues of its line of gas-analysis instruments and allied specialties. Attention is called to the fact that the instruments are not laboratory instruments but are portable, and are built with particular reference to the every-day needs of practical men. The instruments are particularly useful in making flue-gas analysis.

THE H. H. FRANKLIN MANUFACTURING COMPANY, Syracuse, N. Y., gives a good deal of interesting information regarding air cooling and other features of the Franklin automobile in its booklet "Ten Minute Talk With an Automobile Engineer." Mention is also made of the advantages of a positive ignition system. Reliable ignition has been secured in the Franklin by the use of the Bosch high-tension single-ignition system.

THE NERNST LAMP COMPANY, Pittsburg, Pa., shows some excellent examples of store lighting in the June issue of its monthly publication, *The Glower*. One large Chicago store has, since December, 1907, ordered a total number of 1,262 glower units, which shows with what success this system is meeting. An article on "The Value of a Periodic and Systematic Maintenance of a Lighting System" contains a number of very interesting points.

W. N. MATTHEWS & BROTHER, St. Louis, Mo., have recently issued catalogue No. 7 on Matthews' money-saving specialties. Prices and descriptions of Matthews guy anchors, Matthews holdfast lamp guards and other specialties are given, with a number of valuable suggestions. In addition to data on Matthews goods, a general table of useful data is contained in the booklet. This table has a great many features which are of interest to electrical men.

THE GRATON & KNIGHT MANUFACTURING COMPANY, Worcester, Mass., has distributed to the trade a folder on "G & K" leather belting. This folder is sent out under the title of "What Mr. Denniston Says," and in it Mr. Denniston gives an opinion that is the result of fifty-four years' experience as a tanner. In this opinion he states that the leather used by this company is especially fitted for belting. "G & K" products have been on the market since 1851.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., received an order from the Flatbush Gas Company, of Brooklyn, N. Y., for a 2,500-kilovolt-ampere, 2,400-volt, 1,800-revolution-per-minute, sixty-cycle, two-phase turbo-alternator. This will be supplied with one of the new Type "C" condensers recently put on the market by Allis-Chalmers Company. Something over a year ago the Flatbush Company purchased a 750-kilovolt-ampere turbo-alternator from the same manufacturers.

THE PENBERTHY INJECTOR COMPANY, Detroit, Mich., states in a recent letter that on March 29, 1910, injector No. 600,000 was stamped and recorded ready for delivery. Calculating the capacity of the two and one-half-inch injectors made by this com-

pany since 1887, it is found that they would force one-third of the water going over Niagara Falls, into a boiler against 100 pounds pressure. In figures, the total capacity of these 600,000 size "GG" injectors is approximately 2,520,000 gallons per minute.

THE STONE & WEBSTER ENGINEERING CORPORATION of Boston, Mass., has begun work on a contract for the redevelopment of the water-power property of the Laconia Gas and Electric Company at East Tilton, N. H. A new concrete power station of 800-killowatts capacity will be built together with a seven mile transmission line to Lakeport. Step-down apparatus will be installed in the company's plant at the latter point. The present dam will be reconstructed, new head-gates will be installed and the canal will be widened at both ends.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., has recently published four bulletins dealing with its small motors. Bulletin 3,138 describes the single-phase induction motor which is made in sizes from one-eighth to one-fifth horsepower for automatic start. Motors for family washing machines are treated in bulletin 3,962, which contains a drawing showing the motor belted to a washing machine. Bipolar ventilated motors for direct current, and buffing lathes for alternating and direct current are described in bulletins No. 3,217 and No. 3,707 respectively.

THE NATIONAL ELECTRIC LAMP ASSOCIATION calls attention, in its bulletin of May 2 to the requirements of good illumination, bringing out the point that too much light is as bad as too little. The figure given for intrinsic brilliancy per square inch of luminous area is from four to six candlepower, when the source of light is in the field of vision. Comparison is made of the direct and indirect methods of illumination, and photographs taken by this artificial light are reproduced in the bulletin. Considerable information is given regarding the calculation of illumination, and illumination tables are given for Mazda lamps of various sizes.

THE NATIONAL BRAKE AND ELECTRIC COMPANY, Milwaukee, Wis., describes in bulletin No. 390, recently issued, the National governors, Types "N," "R" and "A." These three distinct types; the oil-pneumatic, the diaphragm governor and the valve pneumatic governor, were designed to meet the requirements of electric traction companies operating under varying conditions. The construction, operation, installation and adjustment of each type is treated and several illustrations and diagrams are given to aid in the explanation. Bulletin 389, published by the same company describes the various types of National emergency and variable release valves.

THE HOLOPHANE COMPANY, Newark, Ohio, announces that there will be certain changes regarding Holophane material which will go into effect on July 1, 1910. The company has in the first place developed a new standard line of reflectors for the Mazda and tungsten lamps which will supersede the present high-efficiency type. The new reflectors will be on the same list basis as the E, I and F types. A change in prices and discounts in Holophane material will also be put in effect at the same time. All Holophane material will be placed on the same basis, namely, sixty per cent, and packing charges will be entirely eliminated. The new prices will be published in the Holophane data book No. 2, which will be issued July 1.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., announces that it has just opened two new sales offices, one located at 729 Ford Building, Detroit, Mich., and another at 1424 Wazee Street, Denver, Colo. The increasing use of the "Chloride Accumulator" and "Tudor Accumulator" for central stations, telephones and railways, and an enormous increase in the use of the "Exide" battery for electric vehicles, gas-engine ignition, etc., has made it advisable to establish these offices, so that customers in adjacent territory will be better served. A stock of battery material will be carried in Denver, from which orders can be promptly filled. The addition of these offices, as well as the St. Louis "Exide" storeroom recently opened at Sixteenth and Pine streets, very materially increases the facilities of this company in the West.

THE SANGAMO ELECTRIC COMPANY, Springfield, Ill., publishes a very complete and interesting description of its mercury type meter in the convention issue of the *Sangamo Bulletin*. Several two-color illustrations show the arrangement of the meter and the part that the mercury takes in floating the motor element. The use of he mercury does away with a lower bearing and at the same time makes the friction exceedingly small. A feature of this issue of the Bulletin is a double page devoted to a brief history of the Sangamo Electric Company. In the margin surrounding the reading matter are a number of illustrations showing different parts of the Sangamo factory. The company is also sending out a booklet entitled "The Ampere Hour Meter for Electric Vehicles." It is attractively illustrated and contains a number of valuable pointers regarding meters.

### DATES AHEAD.

Mississippi Electric Association. Annual convention, Greenville, Miss., June 15 and 16.

Master Car Builders' Association. Annual convention, Atlantic City, N. J., June 15, 16 and 17.

Railway Supply Manufacturers' Association. Exhibition of railway appliances, etc., Atlantic City, N. J., June 15 to 22, inclusive.

Master Mechanics' Association. Annual convention, Atlantic City, June 20, 21 and 22.

American Society of Civil Engineers. Annual convention, Chicago, Ill., June 21-24.

American Institute of Chemical Engineers. Semi-annual meeting, Niagara Falls, N. Y., June 22-24.

Society for the Promotion of Engineering Education. Annual meeting, Madison, Wis., June 23-25.

New York Street Railway Association. Annual convention, Cooperstown, N. Y., June 27 and 28.

American Institute of Electrical Engineers. Annual convention, Waumbeck Hotel, Jefferson, N. H., June 27, 28, 29 and 30.

American Society for Testing Materials. Annual meeting Atlantic City, N. J., June 28-July 2.

American Society of Heating and Ventilating Engineers. Semi-annual meeting, St. Louis, Mo., June 30-July 1.

Southern Textile Association. Convention, Augusta, Ga., July 2.

National Electric Contractors' Association. Annual convention, Atlantic City, N. J., July 20, 21 and 22.

Ohio Electric Light Association. Annual convention, Cedar Point, Ohio, July 26, 27 and 28.

Michigan Electrical Association. Annual convention, Port Huron, Mich., August 16, 17 and 18.

League of American Municipalities. Annual convention, St. Paul, Minn., August 23-26.

Pacific Coast Exposition. San Francisco, Cal. August 20 to August 27, 1910.

Colorado Electric Light, Power, and Railway Association. Next convention, Glenwood Springs, Col., September 21, 22 and 23.

Canadian Electrical Association. Annual convention, Lake Rosseau, Otario, Canada, July 6, 7 and 8.

# Directory of Electrical and Allied Engineering and Scientific Societies

**(Published in the second issue of each month.)**

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WISCONSIN ELECTRICAL ASSOCIATION. Secretary, John S. Allen, Lake Geneva, Wis.
WISCONSIN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. C. Crowley, Jr., Superior, Wis.

# RECORD OF ELECTRICAL PATENTS.

**Issued (United States Patent Office) May 31, 1910.**

959,452. COIL-BENDING MACHINERY. James A. Burns, Homestead, and James W. Swoger, Pittsburg, Pa., assignors to Westinghouse Electric & Manufacturing Company. Filed July 3, 1905. An adjustable block is engaged by a lever-operated cam.

959,458. DOUBLY-ACTUATED EXPANSION-VALVE. George P. Carroll, Bridgeport, Conn. Filed April 30, 1907. May be electrically or independently operated.

959,462. CALL-DISTRIBUTING SWITCH. Peter Valdemar, Christensen, Copenhagen, Denmark, assignor to Aktiebolaget L. M. Ericsson & Co., Stockholm, Sweden. Filed June 23, 1906. Includes a search magnet and selecting contacts.

959,485. AUTOMATIC TELEPHONE SYSTEM. Alfred H. Dyson, Chicago, Ill., assignor to Kellogg Switchboard & Supply Company. Filed January 8, 1909. Has an automatically operative trouble switch.

959,486. ELECTRODE SUPPORT AND CONDUCTOR. Isaac R. Edmands, Niagara Falls, N. Y., assignor to Electro Metallurgical Company, New York, N. Y. Filed January 8, 1909. A vertically adjustable electrode is connected at one end to a flexible conductor, the other end of which is secured to a fixed electric main, and a counterbalanced adjustable support for maintaining the conductor is provided between the electrode and the main.

959,497. ELECTRICAL MEASURING INSTRUMENT. Charles Edwin Foster, Rochester, N. Y. Filed February 24, 1908. At the ends of a thermal member are a pair of bending members, having greater flexibility than the thermal member and offering less resistance to the passage of an electric current, and means are provided for directing an electric current through the bending members and the thermal member.

959,498. TELEPHONE-EXCHANGE SYSTEM. Samuel B. Fowler, La Fayette, Ind. Filed May 27, 1907. Armature mechanisms for a cut-off relay apparatus co-operate mechanically to control line and supervising signals.

959,510. RECEIVING APPARATUS FOR WIRELESS TELEGRAPHY. Robert R. Goldthorp, Hartford, Conn. Filed Oct. 29, 1909. A receiving apparatus for wireless telegraphy comprises a hollow tuning coil, a condenser located within the coil and supported from one end of it, a condenser regulator mounted at the opposite end of the coil, electrical connections between the condenser and the regulator, and a detector mounted within the coil.

959,521. ELECTROLYTIC APPARATUS WITH LIQUID ANODE. Konrad Hahn, Winkel, near Gifhorn, Germany, assignor to Schott & Gen., Jena, Germany. Filed May 27, 1909. An electrolytic apparatus comprises an anode vessel, a cathode vessel, a mouth projecting upwardly from the cathode vessel into the central part of the anode vessel, a liquid anode encircling the mouth, a solid cathode, an electrolyte contained in both vessels, and a solid annular body arranged in the anode vessel so as to surround the mouth of the cathode vessel and restrain the agitation of the anode.

959,525. ELECTRIC GAS-LIGHTING APPARATUS. David M. Hartford, Carleton M. Taylor, and Lewis S. Stone, Los Angeles, Cal. Filed April 26, 1909. Includes sparking points to light the gas.

959,544. ELECTRIC APPARATUS. Ray P. Jackson and Harold M. Scheibe, Wilkinsburg, Pa., assignors to Westinghouse Electric & Manufacturing Company. Filed January 21, 1909. A relay switch comprises a stationary frame, stationary and movable core members, an actuating coil for opening the switch, a lever operatively connected to the switch, means for opposing the final action of the magnet winding to a greater degree than the initial action of the magnet winding, and means dependent upon a slight energization of the coil for locking the switch in an intermediate open position.

959,548. ELECTRIC DRIVING DEVICE FOR REGISTERING-MACHINES. Charles F. Kettering, Dayton, Ohio, assignor to The National Cash Register Company, Dayton, Ohio. Filed July 15, 1905. Renewed October 20, 1908. A source of electric energy is included in a circuit with an inductive element; a switch makes and breaks the circuit; and a shunt circuit between the terminals of the switch includes a condenser and an inductive resistance.

959,551. ELECTRICAL MEASURING INSTRUMENT. Samuel M. Kintner, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed March 17, 1905. An electrical measuring instrument comprises vertically elongated and relatively movable members, a body of compressed fluid in which they are immersed, and a metallic receptacle for the fluid.

959,552. FUSE FOR ELECTRICAL CIRCUITS. Samuel M. Kintner, Pittsburg, Pa., and Girard B. Rosenblatt, New York, N. Y., assignors to Westinghouse Electric & Manufacturing Company. Filed November 4, 1905. The fuse comprises a sealed insulating tube of frangible material and a fusible conductor suspended therein, means for making circuit connections to the terminals of the fusible conductor, a receptacle filled with insulating liquid in which the insulating tube is immersed, and an insulating strip located within the tube and supporting the fusible conductor throughout its length.

959,566. CLEANER FOR SHIPS' HULLS AND THE LIKE. William Richard Macdonald, Eel Pie Island, Twickenham, England. Filed November 21, 1908. An apparatus for cleaning submerged iron surfaces comprises a plurality of battens, flexible connections between the battens, curve-faced brushes on the battens, and electromagnets on the battens side by side with the brushes, with pole-faces more sharply curved than the brush faces.

959,569. MAGNETIC CLUTCH. Frederick Ripon Martin and Oswald Montagu Shepherd, London, England. Filed Feb. 13, 1907. A magnetic clutch includes a wire-equipped core, with the wire coiled in separate and continuous sections or coils and a lead wire connected thereto about midway of the wire of the sections or coils, and means for rapidly demagnetizing one coil or section thereof for releasing the clutch.

959,572. SWITCH FOR INCANDESCENT LAMPS. James A. Me-

bane, South Boston, Va. Filed March 21, 1908. The socket contains a ratchet and double-cam device.

959,594. ELECTRIC-LAMP SOCKET. Johann G. Peterson, Hartford Conn., assignor to The Arrow Electric Company, Hartford, Conn. Filed November 3, 1909. The socket has a shell with outwardly projecting tongues, a cap fitting the shell, a perforated split ring located in the cap, and depressions from the cap retaining the ring in position, the tongues being adapted to enter opening in the ring when the shell and cap are put together.

959,609. ELECTRIC VALVE. Frank N. Roehrich, Jersey City, N. J., assignor to George P. Carroll, Bridgeport, Conn. Filed July 30, 1909. A magnetizable device wholly within the valve chamber, normally holds the valve in whichever position it may be positioned, and operates when magnetized to release the valve, and an electric device wholly without the chamber operates when energized to magnetize the magnetizable device.

959,613. RELAY-SWITCH. Harold M. Scheibe, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed January 21, 1909. A relay switch comprises a movable contact member, an actuating lever therefor, weights suspended from the lever and tending to close the switch, and means dependent upon a predetermined movement of the contact member from either its open or its closed position for holding the switch in an intermediate open position.

959,618. ELECTRIC VALVE. Louis M. Schmidt, New Britain, Conn., assignor to George P. Carroll, Bridgeport, Conn. Filed May 6, 1909. Comprises a solenoid winding, a valve chamber having a valve seat and having an imperforate part of its wall within the winding, a valve within the chamber initially closing the seat, and a magnetizable core secured to the valve and operating upon the passage of a current through the winding to move within the part of the chamber within the winding and to open the valve.

959,620. PROCESS FOR MAKING INSULATING MATERIAL. William R. Seigle, Nashua, N. H. Filed December 20, 1909. The process consists in first forming a compacted composition of fibrous material, cement and finely divided liquefiable solid hydocarbon distributed therethrough, and then immersing the composition in liquefied hydrocarbon at a temperature sufficiently high to liquefy the included hydrocarbon.

959,621. CABLE-REELING MECHANISM FOR ELECTRIC LOCOMOTIVES. Frank L. Sessions, Columbus, Ohio, assignor to The Jeffrey Manufacturing Company. Filed December 18, 1905. Renewed August 11, 1908. A cable spooling and guiding device for directing the cable onto the reel, comprises a double-threaded shaft, a follower adapted to travel along the shaft, supporting arms for the shaft pivoted about the axis of the reel, means for rotating the shaft, and brackets for engaging the supporting arms and holding the shaft and follower at different points about the periphery of the reel.

959,634. BRUSH OR COLLECTOR FOR ELECTRICAL MACHINES. Simon Sparrow, St. Louis, Mo., assignor to Wagner Electric Manufacturing Company, St. Louis, Mo. Filed February 23, 1909. A collecting member is provided with a cylindrical cavity in which is located a spring under compression, an a flexible conductor lies between the spring and the wall of the cavity.

959,641. SWITCHBOARD FOR DENTAL, MEDICAL OR SURGICAL PURPOSES. David Stern, Cincinnati, Ohio. Filed July 6, 1909. Includes high-voltage feed terminals, rheostat resistances, low-voltage switch, high-voltage distributing terminals, etc.

959,645. MECHANICALLY-CONTROLLED AUTOMATIC ELEVATOR. August Sundh, Yonkers, N. Y., assignor to Otis Elevator Company, Jersey City, N. J. Filed October 2, 1907. Electrical circuits for the motor are located outside of the path of travel of the car, a plurality of independently operable circuit control devices within the car, and mechanical connections are located between these devices and the circuits.

959,646. ELECTROSTATIC SEPARATING PROCESS. Walter G. Swart, Denver, Colo., assignor to The Blake Mining and Milling Company. Filed January 18, 1905. Serial No. 241,599. The process consists in treating disintegrated material with a dilute solution of copper sulphate to cause a diverse deposition upon the particles of different material, in drying the material and in electrostatically separating the same.

959,651. DYNAMO-ELECTRIC MACHINE. Egbert M. Tingley, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed August 2, 1906. The rotor has ventilating holes through it, perpendicular to its axis, and air deflectors at the ends of the holes.

959,658. LIGHTNING-ARRESTER. Hugh C. Walford, Berlin, Ontario, Canada. Filed November 23, 1908. A lightning-arrester system comprises a rotatably mounted disk; a series of arresters carried by the disk each including an independent air gap; a common ground for the arresters; and a contact arm for connection electrically with a line wire and adapted to engage the arresters successively as the disk is rotated.

959,718. RAIL-BOND. William B. Cleveland, Cleveland, Ohio, assignor to The Electric Railway Improvement Company, Cleveland, Ohio. Filed May 2, 1908. A rail-bond comprises a plurality of strands, and clips securing the ends of the strands together to form the terminal portions of the bond, the clips extending inwardly beyond the inner ends of the faces of such terminal portions designed to contact with the rail.

959,730. PROCESS OF TREATING ELECTROLYTIC AND SIMILAR SOLUTIONS. George A. Gabriel, New York, N. Y., assignor to Bleach & Caustic Process Company, New York, N. Y. Filed May 31, 1907. An electrolytic process comprises, in combination with the step of electrolysis, a continuous cycle of steps constituting a circulation of the electrolyte, for supplying pure electrolyte equal to that decomposed or discharged, and a cycle of steps constituting an auxiliary circulation for purifying and strengthening the electrolyte, treating in said cycle a greater volume than in the main cycle.

959,765. TELEPHONE SYSTEM. Albion D. T. Libby, Elyria, Ohio, assignor to The Dean Electric Company, Elyria, Ohio. Original application filed May 28, 1909. Divided and this application filed Nov. 8, 1909. A three-strand cord at the central exchange connects two of the substation lines for conversation, two of the strands being connected directly to a common contact of the central-exchange switching means to complete two independent circuits in the cords.

959,769. ELECTRIC SWITCH. Wesley Duncan Richard MacDiarmid, Ottawa, Ontario, Canada, assignor of one-third to Horace Casler Dier and one-third to Claude Elmer Wiltsie, Ottawa, Canada. Filed June 3, 1908. A commutator switch.

959,770. HEADLIGHT. Rob Roy Macdonald, Woodbury, N. J. Filed June 13, 1908. Describes circuit connections, etc.

959,787. CIRCUIT-CONTROLLING APPARATUS. Lloyd Carlton Nicholson, Buffalo, N. Y. Filed July 22, 1908. Two polyphase transmission lines are connected at each end with a circuit breaker in each, a relay arranged to actuate either of the circuit breakers but normally ineffective, means for producing currents corresponding respectively to the algebraic sum of the currents in the two transmission lines and means for causing the currents simultaneously to act upon the relay.

959,788. CIRCUIT-CONTROLLING APPARATUS. Lloyd Carlton Nicholson, Buffalo, N. Y. Filed July 22, 1908. Similar to preceding.

959,807. SAFETY-FUSE. Joseph Sachs and Frank D. Reynolds, Hartford, Conn., assignors to The Sachs Company, Hartford, Conn. Filed March 22, 1906. A safety fuse comprises a tube, end caps therefor, a fuse strip inclosed therein, and means between an end cap and the tube for indicating the condition of the fuse strip.

959,818. LOCKING DEVICE FOR INCANDESCENT LAMPS. Clarence J. Timm and James A. Barnhardt, Duluth, Minn. Filed April 27, 1909. A spring catch having a loop at one end is adapted to encircle the base of the lamp, and a hook at its inner end engages a keeper.

959,827. CIRCUIT-BREAKER. Maurice J. Wohl, New York, and Harry Hertzberg, Brooklyn, N. Y., assignors to Abbot A. Low, Horseshoe, N. Y., Maurice J. Wohl, New York, N. Y. and Harry Hertzberg Brooklyn, N. Y., trustees. Filed March 20, 1908. Includes a thermally exponsible conductor.

959,864. ELECTRIC CLOCK. Rudolph Jaegermann, St. Louis, Mo. Filed February 14, 1910. The pendulum is impelled by a reciprocating electromagnetically actuated armature.

959,872. ELECTRIC HEATER. James F. McElroy, Albany, N. Y., assignor to Consolidated Car-Heating Company, Albany, N. Y. Filed June 25, 1907. Comprises a conduit inclosing a leading-in wire, a heater base, an electric heating resistance mounted thereon, means for clamping the conduit to the base, and a junction-box covering the clamping means and the connection between the leading-in wire and the heating resistance and adapted to be removed and replaced without disturbing the clamping means or connection.

959,886. ELECTRICAL SWITCHBOARD. Joseph A. Schaefer, Chicago, Ill., assignor to John Schaefer, Chicago, Ill. Filed July 15, 1907. Describes in detail a board of special design.

959,887. SPEED AND CIRCUIT CONTROLLING APPARATUS FOR ELECTRIC MOTORS. Joseph A. Schaefer, Chicago, Ill., assignor to John Schaefer, Chicago, Ill. Filed Aug. 24, 1907. Includes a main switch, regulating switch, etc.

959,901. DYNAMO-ELECTRIC MACHINE. Louis E. Underwood and Charles P. Smith, Lynn, Mass., assignors to General Electric Company. Filed October 27, 1906. A rotor member for dynamo-electric machines consist of a shaft, a spacing member on the shaft, a pair of cores mounted on the shaft on opposite sides of the spacing member and held against the ends of the member, and windings on one of the cores having end turns or connections supported upon the spacing member.

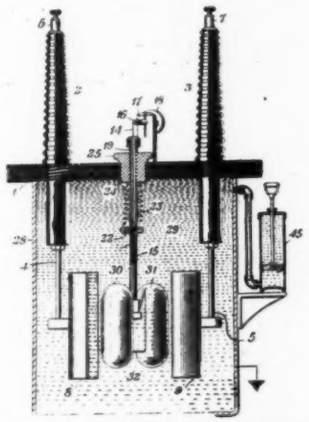
959,907. MOTOR-CONTROLLER. Thomas E. Barnum, Milwaukee, Wis., assignor to The Cutler-Hammer Manufacturing Company,

Milwaukee, Wis. Filed March 14, 1907. Comprises a plurality of sets of circumferentially arranged contacts, the contacts of each set being electrically connected in pairs and each set of contacts being electrically independent of the other sets of contacts, a resistance connected to each set of contacts, this resistance being divided into sections and each section being electrically connected to a pair of contacts, and a plurality of movable contacts electrically connected in groups, all of the movable contacts being arranged to simultaneously pass over different sets of contacts.

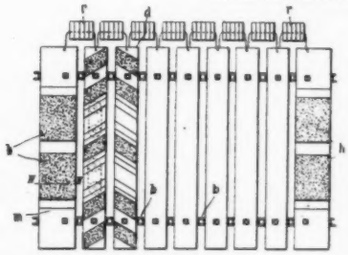
959,908. MOTOR-CONTROLLING DEVICE. Thomas E. Barnum, Milwaukee, Wis., assignor to The Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Filed May 9, 1907. Comprising arc-shaped contacts, plurality of sets of circumferentially arranged contacts, a resistance connected to each set of circumferentially arranged contacts, and movable contacts connected in pairs arranged to pass off the contacts, one movable contact of each pair being arranged to always be in engagement with the arc-shaped contacts.

959,909. CRANE-CONTROLLER. Thomas E. Barnum, Milwaukee, Wis., assignor to The Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Filed August 27, 1907. Similar to the preceding.

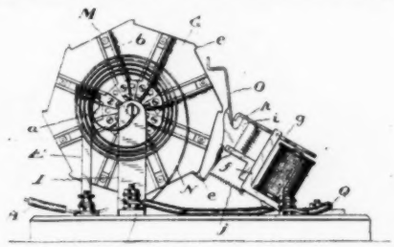
959,910. MULTIPLE-SWITCH STARTER. Thomas E. Barnum, Milwaukee, Wis., assignor to The Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Filed July 26, 1909. The starter includes a plurality of switches tending to stand in open position, and a plurality of latches for holding the switches in closed position, these latches tending to move into a position to release the switches, and each of the switches being adapted, when closed, to retain the latch of a preceding switch in holding position.



959,551.—ELECTRICAL MEASURING INSTRUMENT.



959,566.—CLEANER FOR SHIPS' HULLS.



959,658.—LIGHTNING ARRESTER.

959,913. ELECTRICALLY-HEATED APPARATUS SUITABLE FOR COOKING AND OTHER PURPOSES. Arthur Francis Berry, Ealing, England, assignor to General Electric Company. Filed November 8, 1907. Comprises primary and secondary elements on a magnetic core, a heating portion supported upon but insulated from the core and comprising a metal plate grooved on its lower side, an insulated inductive winding arranged within the groove and constituting an inductive element arranged in circuit with the secondary element, and a casing inclosing the core with primary and secondary elements and surrounding the heating portion.

959,919. ELECTRIC-RAILWAY SYSTEM. Frank E. Case, Schenectady, N. Y., assignor to General Electric Company. Filed November 29, 1905. There are two supply conductor sections, and an intermediate conductor section between the sections and insulated therefrom; a stop or projection is arranged adjacent the roadway between the ends of the intermediate section for operating switch mechanism on a car traversing the intermediate section, and means are provided for electrically connecting the intermediate section to either of the supply conductor sections.

959,929. HIGH-VOLTAGE SWITCH. Walter T. Goddard, Victor, N. Y., assignor to Locke Insulator Manufacturing Company, Victor, N. Y. Original application filed June 12, 1908. Divided and this application filed Oct. 25. An insulator is supported at opposite ends, has a plurality of insulating flanges about it and comprises a plurality of units, and terminals insulated from each other by the insulator have insulating flanges of the latter located between them.

959,934. RESONANCE-TACHOMETER. Robert Hartmann-Kempf, Frankfort-on-the-Main, Germany, assignor to Hartmann & Braun A. G. Frankfort-on-the-Main, Germany. Filed March 12, 1906. Comprises two scales or graduated members, an electromagnet, and two series of resonators, the members of each group being arranged at different distances from the magnet in accordance with the number of vibrations represented thereby and turned in accordance with the values represented by the adjacent scale graduations.

959,944. SWITCH-MOVEMENT. William Kaisling, Chicago, Ill., assignor to Kellogg Switchboard & Supply Company. Filed March 22, 1909. In combination work a movable member provided with a set of ratchet teeth, are a driving pawl for engaging the teeth, an actuating member, a yielding connection between the actuating member and the pawl, and means for locking the movable member against movement until the actuating member reaches a definite point in its movement.

959,954. ELECTRIC GENERATOR. John L. Milton, Chicago, Ill., assignor of one-half to Towner K. Webster, Chicago, Ill. Filed March 22, 1906. An indicator-alternater for ignition purposes.

959,959. DYNAMO-ELECTRIC MACHINE. Jakob E. Noeggerath, Schenectady, N. Y., assignor to General Electric Company. Filed June 30, 1906. A rotary transformer.

959,967. WAVE-RECEIVING DEVICE. Frederick G. Sargent, Westford, Mass. Filed July 8, 1908. A coherer has a pointed zinc electrode, and a conducting metalloid electrode having a flat surface in position to be engaged by the zinc electrode.

959,969. BRANCH BLOCK FOR SUSPENDED CABLES. James S. Stewart, New York, N. Y., assignor to Annie Stewart, New York, N. Y. Filed January 27, 1909. A branch block for suspended cables comprises a body having means for grasping the conductors of the cable, means for grasping the conductors of the extension circuit, means for electrically connecting the conductors of the cable to the conductors of the extension circuit, and a casing having eyes to grasp ummutilated portions of the cable.

959,977. ELECTRICAL CONNECTOR. Frank L. Washburn and George E. Lawrence, Los Angeles, Cal. Filed January 13, 1910. A base for incandescent lamps.

960,000. METHOD OF AND MEANS FOR REVERSING MOTORS. Archibald S. Cubitt, Pittsfield, Mass., assignor to General Electric Company. Filed June 3, 1909. The method of reversing simultaneously two motors normally operated in parallel consists in short-circuiting the fields by establishing the reverse connections between the fields and their armatures while the original connections still exist and then interrupting the original connections.

960,016. WIRE-DRAWING MACHINE AND UNCOILING APPLIANCE THEREFOR. James A. Horton, Providence, R. I., assignor to Iroquois Machine Company, New York, N. Y. Filed April 18, 1906. An uncoiling appliance comprises a coil holder, and a reciprocatable guide adapted to engage and laterally swing the stretch of material passing from a coil on the holder.

960,037. REFLECTOR. William Henry O'Beirne, Pauls Valley, Okla., assignor to Edward J. O'Beirne and Company, Elgin, Ill. Filed September 23, 1909. A reflector for tungsten and similar lamps has a surface formed by revolution of a reversed curve of special form. This was described and illustrated in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, June 4, p. 1188.

960,049. CIRCUIT-BREAKER. Edwin H. Smythe, Chicago, Ill., assignor to General Electric Company. Filed October 21, 1904. Renewed December 18, 1905. Comprises a switch, a lever for closing the switch, a movable fulcrum for the lever (this lever being inoperative to close the switch when the fulcrum is displaced), and electromagnetic mechanism adapted to control the fulcrum.

960,055. ELECTROMAGNETIC BRAKE APPARATUS. August Sundh, Yonkers, N. Y., assignor to Otis Elevator Company, Jersey City, N. J. Filed October 2, 1907. A plurality of electromagnets of varying inductances oppose the brake-applying mechanism, and are of sufficient strength when energized to overcome the power of the applying mechanism and permit the release of the brake.

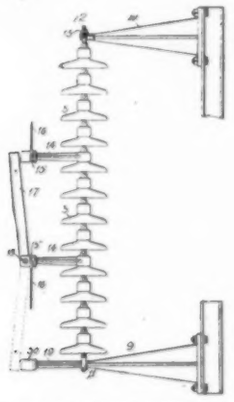
960,065. SUSPENSION MEANS FOR TROLLEY-WIRES. Samuel S. Berkley, Ralphton, Pa. Filed August 27, 1909. A trolley-

wire suspending means includes a hanger comprising an elongated body provided at its ends with depending arms terminating in threaded studs, the body being provided at a point intermediate its ends with an opening having its wall threaded, and stop and reinforcing flanges formed on the arm above the threaded studs.

960,066. THIRD RAIL. Charles A. Bluhm, Michigan City, Ind. Filed March 3, 1909. A third rail comprises guard rails, having hollow centers, conductors located below the slot between guard rails and chairs, the chairs being slotted to receive the guard rails and extended to fit the hollow centers of the guard rails and afford support therefor in their elevated position above the conductor.

960,076. ADJUSTABLE ELECTRIC-LAMP SUPPORT. John B. Coe, Boston Mass., assignor of one-fourth to John E. Hilton, Boston, Mass. Filed November 26, 1909. An adjustable electric-light holder comprises a lamp socket, a reel rotatively mounted upon standards rigidly connected to its socket, an electric-light cord adapted to be wound upon the reel and metallic flanges on the reel on each side of the cord to which the terminals of the latter are respectively connected, the flanges serving both as retainers for the wound-up cord and as conductors for transmitting electric current to the lamp socket.

960,087. BINDING-POST. Gilbert W. Goodridge, Bridgeport, Conn., assignor to The Perkins Electric Switch Manufacturing Company, Bridgeport, Conn. Filed Dec. 17, 1908. A combined contact and binding post.



959,929.—HIGH-VOLTAGE SWITCH.

960,091. SPARK-PLUG HOLDER. Charles Morton Holden and Henry Glowacki Hendershot, San Francisco, Cal. Filed Dec. 21, 1909. A threaded receptacle is screwed in the ignition chamber.

960,093. DYNAMO-MACHINE. Dugald C. Jackson, Madison, Wis. Filed May 16, 1904. Includes a field magnet having salient pole-pieces, and an armature, unequally spaced slots formed in and distributed unequally and entirely across the pole-pieces, and a compensation winding laid in the slots.

960,095. BRUSH-HOLDER FOR DYNAMO-ELECTRIC MACHINES. Carl E. Johnson, Los Angeles, Cal., assignor to United States Electrical Manufacturing Company, Los Angeles, Cal. Filed February 23, 1909. The position of the holder may be varied before it is finally clamped in position.

960,115. NEGATIVE PLATE FOR STORAGE BATTERIES AND PROCESS FOR THE MANUFACTURE THEREOF. Pedro G. Salom, Philadelphia, Pa. Filed July 27, 1909. An initially formed negative plate for a storage battery consists of a conducting support and spongy lead particles mechanically applied as such thereto, in a coherent but noncoalescent mass.

960,124. PUSH-BUTTON SWITCH. George B. Thomas, Bridgeport, Conn., assignor to The Perkins Electric Switch Manufacturing Company, Bridgeport, Conn. Filed November 10, 1909. Serial No. 527,284. A push switch has a standard, a perforated rock lever pivoted thereon, a contact piece moving with the rock lever and a spring pin adapted to engage the perforations in and temporarily detain the rock lever.

960,151. TELEPHONE-SUPPORT. Harry Blumenthal, Dorchester, Mass. Filed July 31, 1909. A telephone support comprises a base, a polygonal member swiveled thereon, a plurality of equiangular but irregular polygonal members movable within the first mentioned member and relatively movable longitudinally one within the other, and means secured to the innermost member for gripping a telephone.

960,152. TROLLEY-POLE. Charles E. Bradford, Lakeview, Wash. Filed August 24, 1909. In combination with a trolley pole having two sections, are joint members having their opposing ends cut away to form shoulders whereby the members may have a limited lateral oscillatory movement with respect to each other, a longitudinal pivot uniting the members, a leaf spring having its central portion secured and its end portions free and projecting between the shouldered portions of the members, and means connecting the members to the trolley pole sections.

960,176. AUTOMATIC DISTRIBUTING SYSTEM. Leroy D. Kellogg, Chicago, Ill., assignor to Kellogg Switchboard & Supply Company. Filed June 15, 1907. A telephone system.

960,186. ELECTRICALLY OPERATED CLOCK. Thomas Mungall, Chicago, Ill. Filed July 30, 1909. Describes the mechanism in detail.

960,222. ELECTRIC-BATTERY CELL. Manes E. Fuld, Baltimore, Md. Filed March 12, 1906. Describes a sealing plug and securing devices for same.

## PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States patent office), that expired June 6, 1910.

498,757. INSULATED CONDUCTOR. Thomas F. Attix, Brooklyn, N. Y.

498,763. ELECTRO-MOTIVE DEVICE. Romaine Callender, Brantford, Can.

498,776. CLAMP FOR ELECTRIC CONDUCTORS. Axel H. Englund, Chicago, Ill.

498,799. RHEOSTAT. Edward R. Knowles, Middletown, Conn.

498,808. TELEPHONE SWITCHBOARD ANNUNCIATOR. Frank R. McBerty, Downer's Grove, Ill.

498,852. CLOSED CONDUIT FOR ELECTRIC RAILWAYS. Charles J. Kintner, New York, N. Y.

498,864. RAILWAY-SIGNAL. James W. Steele, Chicago, Ill.

498,865. RAILWAY-SIGNAL. Joseph B. Stewart, Haverstraw, and William G. Wattson, Tappan, N. Y.

498,869. TELEPHONE HANDLE OR HOLDER. Basil M. Wilkerson, New York, N. Y.

498,871. ELECTRICAL TRANSMITTER FOR TELEMETER SYSTEMS. Charles W. Ayton, New York, N. Y.

498,872. RECEIVER FOR TELEMETER SYSTEMS. Charles W. Ayton, New York, N. Y.

498,878. ELECTRIC-ILLUMINATING APPARATUS. Edward A. Coley, Newark, N. J.

498,879. METHOD OF ELECTRIC ILLUMINATION. Edward A. Coley, Newark, N. J.

498,880. ELECTRIC SWITCH. James Des Brisay, New York, N. Y.

498,901. INCANDESCENT ELECTRIC LAMP. Alexander DeLodyguine, Paris, France.

498,906. CONDUIT RAILWAY-TROLLEY. Michael H. Smith, Halifax, England.

498,907. ELECTRICAL CONDENSER. William Stanly, Jr., and William B. Tobey, Pittsfield, Mass.

498,911. COPYING TELEGRAPHIC APPARATUS. Sylvester P. Dension, Belleville, N. J.

498,915. ELECTRODE FOR ELECTRIC ARC LAMPS. Salomon Heimann, New York, N. Y.

498,919. TELEPHONE. Barton Pickering, Dayton, Ohio.

498,929. ELECTRIC GLOW-LAMP. Edward A. Colby, Newark, N. J.

498,933. ELECTRIC-RAILWAY TROLLEY. James R. Griffiths, Chicago, Ill.

498,969. DYNAMO-ELECTRIC MACHINE. William S. F. Dillon, Chicago, Ill.

498,973. METHOD OF AND APPARATUS FOR ELECTRIC PERFORATING. Dexter M. Garnett, Evanston, and John H. Garnett, Chicago, Ill.

498,987. NON-INTERFERENCE SIGNAL BOX. Charles E. Ongley, New York, N. Y.

498,988. ELECTRIC SIGNAL AND PROTECTIVE SYSTEM. Charles E. Ongley, New York, N. Y.

499,003. ELECTRICAL CALL-BOX. Walter F. Banks, Milford, Conn.

499,062. ELECTRIC TIME-SIGNAL. Gerhard W. Van Vianen, Cologne, Germany.

499,097. ELECTRICAL-ILLUMINATING APPARATUS. Edward A. Colby, Newark, N. Y.

499,099. ELECTRO-DYNAMIC MACHINE. Olof Dahl, Paterson, N. J.

499,108. TELEPHONE. Edward M. Harrison, Fort Smith, Ark.

499,112. OVERHEAD ELECTRIC RAILWAY. John C. Henry, New York, N. Y.

499,115. ELECTRIC-RAILWAY TROLLEY. George W. Hooper, Rochester, N. Y.

499,125. ELECTRIC-SIGNAL APPARATUS AND SYSTEM. Jacob W. Lattig, Easton, Pa.

499,126. ELECTRIC-SIGNALING APPARATUS AND SYSTEM FOR RAILWAYS. Jacob W. Lattig, Easton, Pa.

499,150. ADVERTISING OR OTHER ILLUMINATING EFFECT. Horace F. Simon, London, England.

499,167. TROLLEY-WIRE CURVE. Rudolph M. Hunter, Philadelphia, Pa.

499,183. FRICTION CLUTCH FOR ELECTRIC MOTORS. Olof Dahl, Patterson, N. J.